THE
ELECTRICAL REVIEW.

VOL. XCI. JULY 21, 1922. No. 2,330.

ELECTRICAL REVIEW.

Vol. XCI.] CONTENTS: July 21st, 1922. [No. 2,330.

	Page
Compulsory Wiring Rules	73
Electricity in Factories	74
Rubber	74
Legislation on Industrial Lighting	74
Railway Goods Rates	75
A Call to Labour	75
The Nerves of the Nations, by Roland Belfort	76
Calculating Currents in a Mesh-connected Three-phase Circuit, by Alfred Still (*illus.*)	78
The Incorporated Municipal Electrical Association	78
Correspondence—	
Where are the Wiremen?	79
The I.E.E.'s Outlook	79
The I.E.E. Wiring Rules	79
Where are the Young Men of the I.E.E.?	80
Proposed Emigration—New Zealand	80
Reviews	80
Business Notes	81
Notes	87
The Supply of Electricity to Paris (*illus.*)	89
City Notes	97
Stocks and Shares	100
An All-electric Kitchen (*illus.*)	101
Lighting in Factories and Workshops	102
Electricity in Factories	102
New Electrical Devices, Fittings, and Plant (*illus.*)	103
The New Queenston-Chippawa Generators (*illus.*)	105
Legal	106
Exports and Imports of Electrical Goods for June, 1922	107
Parliamentary Notes	107
New Patents	108
Published Specifications	108
Contractors' Column	Advertisement page xxx

"ELECTRICAL REVIEW" SUBSCRIPTION RATES.

UNITED KINGDOM	£1	14	8 per annum.
CANADA	1	12	6 do.
COLONIAL and FOREIGN	2	1	6 do.

Postage Free.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE, 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGREKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon and Gotch, Cimitiere Street
MELBOURNE: Peter G. Tait, 90, William Street, Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 8, Warren Street.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Ditta P. Maglione & C. Strini, 98, Via Due Macelli.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt St.
TOKYO: Maruzen Co., Ltd., 11-16, Nihonbashi-Tori-Sanchome.
TORONTO, ONT.: Wm. Dawson and Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW LIMITED, and crossed "London Joint City and Midland Bank, Newgate Street Branch."

COMPULSORY WIRING RULES.

A CORRESPONDENT draws attention in this issue to a question raised at the recent I.M.E.A. Convention—whether supply authorities should be given power to compel the observance of wiring rules, such as those formulated by the Institution of Electrical Engineers. This is a very important matter, on which conflicting views are held amongst the supply authorities themselves; as Mr. Purse pointed out, the power companies are rigidly opposed to compulsory rules, and many municipal authorities side with them, but the I.M.E.A. voted in favour of compulsion. At present, with certain exceptions, the supply authorities are not entitled to impose any rules at all upon contractors or consumers; if an installation complies with the simple conditions prescribed in the Electric Lighting Acts, the supplier is compelled by law to connect it to the mains. Subject to the exceptions referred to above, local rules are enforced only by bluffing on the part of the authority, and the I.E.E. rules similarly are in no sense compulsory, except when they are specified by the owner of the installation himself. These and other points were fully explained by Mr. Charles A. Baker, electrical engineer to the London County Council, in a forceful article which we published in our issues of April 18th and 25th, 1919.

We are strongly in favour of the adoption of one standard set of wiring rules; local conditions of climate, &c., are practically uniform throughout the country, so far as indoor wiring is concerned, and there is no justification for the use of differing sets of rules. There are, however, important considerations to be taken into account when the question of compulsion is raised.

In the first place, compulsion implies inspection; to set up obligatory rules without appointing inspectors to see that they are carried into effect would be futile. Are the supply authorities prepared to undertake the duties of inspection whilst work is in progress? If so, will they seek powers to charge fees for such inspection? —they possess no such powers at present. If the verdict of the inspector is adverse, presumably the installation will not be connected to the mains, and the owner will have to compel the contractor to rectify the defects. Where the supply authority has a wiring department, there will be a suspicion that the inspector treats its work more leniently than that of the rival outside contractors—complaints are already common enough that the wiring department's installations are connected without demur, whilst the scales are heavily weighted against the contractors'.

By fees, rectifications, and delays, obstacles may thus be placed in the way of the development of the domestic load, which is of the first importance to-day—and goodness knows, there are quite enough obstacles to its development already. In our issue of April 25th, 1919, we emphasised the urgent necessity of facilitating connection to the mains: "A new phase in the history of electricity supply is opening before us. Let us cast away all hampering, unnecessary restrictions, and *welcome* the new consumer; make his path easy, and abandon the tradition which requires that he shall fight his way through the wire entanglements and pitfalls which have embarrassed him up to now. The supply undertakers are the servants of the public, not their masters."

Another important matter is the tenor of the wiring rules themselves. The adoption of compulsory rules at once calls for a material reduction in their rigour; optional rules may be formulated in accordance with ideals, but compulsory rules must conform with practical possibilities and be simple and elastic. Commenting on the article by Mr. C. H. Wordingham in our issue of September 17th, 1920, we expressed the view that the standard of wiring set up by the I.E.E. rules, admirable as they were, was far in excess of reasonable requirements—thousands of installations which broke the rules in all directions had given satisfaction for long periods of years, and still gave satisfaction. Mr. Wordingham held that the rules should be graded—those extant aimed at securing the very highest class of work, and were well enough for important installations, but they were far too stiff for the small house; hence he proposed that rules should be drawn up for grades "rising from that which is just safe and the plainest of the plain, to that which is the best and most elaborate that money can buy." If compulsion is adopted, the only set of rules that can be imposed upon all and sundry is necessarily that relating to the lowest grade. The wiring rules of the I.E.E. are now in course of revision, and it will be interesting to see whether the new edition complies with this condition.

Finally, we must harp again upon the familiar string—that the electricity supply industry must cater for the middle-class and industrial-class house to the utmost possible extent. Shoddy wiring is an evil which cannot be condoned; but any step which tends to impose new and unnecessary restrictions upon the development of the industry, or to place obstacles in the way of the prospective consumer, must be strenuously resisted.

Electricity in Factories.

The chief feature of the annual report of H.M. Chief Inspector of Factories and Workshops for 1921, to which further reference is made elsewhere in this issue, is its brevity; only short summaries embodying some of the more important points in the interesting and valuable reports from the inspectors throughout the country have been included in it this year, a procedure that is to be regretted.

The chapter on the generation and use of electricity occupies 4½ pages only, but it is satisfactory to note that H.M. Senior Electrical Inspector, Mr. G. Scott Ram, confirms the impression that, in general, the quality of new work on factory premises continues to improve, and that electrical manufacturers have done much to improve apparatus and accessories from the safety point of view. Attention is drawn, however, to cases where the occupier, not possessing technical knowledge, relies entirely on a contractor who secures the order on price considerations only, and sometimes being incompetent or unscrupulous, carries out the work in an inferior and often dangerous manner. It should be remembered that the occupier, being responsible under the Factory Acts, should be careful to make it a condition of his order that the work shall be done in accordance with the requirements of the regulations.

Again, apparatus is not infrequently described as "complying with the Factory Acts' requirements," which in reality has never been submitted for the approval of the authorities concerned, and not only does not comply with the requirements, but is wrongly constructed in essential particulars.

The number of accidents due to electricity recorded during the year covered by the report shows a reduction of 20 per cent. on the total and 50 per cent. on the fatal cases, as compared with each of the two preceding years. The reduction in the total is doubtless partly due to the higher standard of electrical work generally, but it may have been to some extent influenced by slackness in trade, many undertakings having been inactive during part of the year under review. The reduction in the relative proportion of fatal cases is also satisfactory, but cannot be regarded as a permanent improvement, as so much depends upon the chance circumstances of the accident.

The reduction in the fatalities is entirely in respect of the low-pressure shock cases; the majority of the h.p. accidents occurred in public electricity supply stations, and the report points out that the employment of labourers or other unskilled persons on dangerous work in such stations, and without proper supervision, is still far too prevalent. An actual test by a suitable instrument to prove that the conductors have been isolated and made dead before work is commenced thereon is obviously the safest course to adopt. Instruments specially designed for that purpose have already been in use long enough to prove their usefulness, more than one serious accident having been known to have been prevented thereby.

Rubber.

The position of rubber has been most unsatisfactory from almost every point of view since the end of the war, and values have declined to unprecedentedly low levels. This, of course, was the inevitable outcome of the great expansion in the production of plantation rubber, accentuated by an abnormal depression in the general trading conditions of the world. The natural result was the creation of an enormous accumulation of surplus stock, the quantities in London alone at the beginning of this month totalling well over 71,000 tons, compared with about 69,000 tons a year ago, and about 23,000 tons two years ago. In addition to the stocks in this country, large stocks are believed still to exist in America. The obvious corrective to this position would, of course, be to restrict production, but although untiring efforts have been expended in order to secure concerted action towards that end, the obstacles to be overcome have up to the present prevented any tangible result. Plantations with a low producing cost, which could sell rubber without loss at or about current market figures, see little to be gained by restricting output for the benefit of those less favourably placed, which might be forced out of action altogether if economic forces were permitted to have free play. Another and probably greater difficulty, however, has been that of bringing the producing interests in the Dutch East Indies into line with those in British possessions. Latterly, the Dutch planters have shown decidedly more willingness to co-operate, and this has led to a considerably more hopeful feeling in rubber trading circles. So far, the low price does not seem to have done much to stimulate consumption, but no doubt the generally adverse conditions of trade in every description of goods, and the chaotic condition of Europe, are partly to be blamed for this. America is, of course, the largest consumer, and the excellent demand in evidence in the motor industry there ought to mean a good consumption for tires. Efforts have been made to discover and encourage new uses for the commodity, and as the economic and commercial conditions of the world stabilise themselves, the market should gradually feel the benefit, more especially if the proposals for curtailment of production are carried into effect. There is, however, a lot of rubber to be absorbed before the position can be regarded as healthy.

Legislation on Industrial Lighting.

The appearance of the third report of the Departmental (Home Office) Committee on Lighting in Factories and Workshops, an abstract of which will be found elsewhere in this issue, marks a new stage in progress toward legislation on industrial lighting. The Committee has already recommended that the omission of any requirement on this point in the Factory Acts should be rectified by the insertion of statutory provisions requiring "adequate and suitable lighting" in general terms. It has also specified minimum values of illumination necessary in the interests of safety, and has dealt with such matters as glare, flicker, and troublesome shadows in

general terms. It has recently had under consideration the more complex question of defining the conditions of illumination necessary for the actual carrying-on of work. Briefly, the conclusion arrived at is that much more experience is needed before legal minima for this purpose can be laid down. Instead of that, the Committee prefers merely to make recommendations, indicating good modern practice, for a very comprehensive list of industrial processes, prior to more detailed investigations being made in which the industries concerned should share. There is little doubt that all the recommendations of the Committee, based as they are on actual tests in many factories, will prove easy to comply with, and the moderate course it has adopted is justified by the fact that industrial lighting has improved very greatly since its work was commenced. In order to avoid hardship, legal minima for working illumination would presumably have to be fixed on the low side; they might, therefore, actually have the effect of impeding further progress. The educational propaganda of the Illuminating Engineering Society has created a general belief in the practical value of good lighting, and managers of factories and workers should readily accept recommendations made in their interest. What is chiefly needed in the future is further educational work so that the fundamental principles of good lighting may be more clearly understood.

Railway Goods Rates.

As the result of an agreement between the Federation of British Industries and the English and Welsh railway companies regarding reductions in the rates for the carriage of goods on railways, there will now be no need for the promised inquiry by the Railway Rates Advisory Committee into the application of the Federation for a 50 per cent. reduction in the increase over the pre-war rates. Both parties are to be congratulated on the arrangement that has been come to, which, in the circumstances, must be regarded as a fair compromise. The arrangement is a general reduction, to come into force on August 1st, 1922, on merchandise traffic by goods train, so that the rates will be 75 per cent. above the rates in operation on January 14th, 1920, in place of 100 per cent. as at present, this to apply to both class and exceptional rates. Any concessions already made which bring the rate below 75 per cent. above the corresponding rate in 1920 will remain unaffected by this settlement. The flat rate increases are to be reduced as follows: 1s. to 6d.; 9d. to 4d.; and 6d. to 3d., the remaining 3d. rate being unaffected. The rate for smalls will be reduced from 150 per cent. to 100 per cent. over the 1920 rate.

The parties to this arrangement agree not to make application for a general alteration to come into operation before July 31st, 1923, and this will give the railway companies ample opportunities to test the wisdom of reducing rates with a view, not only to stimulating trade generally, but also to increase their own traffics. There is little doubt that trade in this country is severely handicapped by high railway freights, and anyone in doubt of that statement need only refer to the proceedings before the Railway Rates Advisory Committee when the new classification was being investigated. That particular inquiry did not include the fixing of actual rates, which was a matter to be dealt with thereafter. The compromise now made merely improves the present position which it must be confessed the railway companies have shown considerable reluctance to modify, having got their increases when the railways were under Government control. Since then, however, there have been considerable reductions in wages and raw materials without any corresponding advantage to the trader. It used to be regarded almost as a joke that goods could come from many hundreds and even thousands of miles from overseas more cheaply than they could be transported a few miles within the confines of Great Britain, but the fact is that to-day there are innumerable such cases, and it is high time that the railway companies were brought into a little more intimate relationship with the real needs of the trade of the country. In America, there is that close relationship already, and there are instances in which the rates from the Atlantic to the Pacific border have been reduced considerably in order to enable industries to meet competition, particularly in the matter of export trade. After all, dullness in trade is reflected in the railway revenue, and the railways cannot be regarded in any other light than as an integral part of the whole industrial fabric which is the foundation of national life. Although there are almost continuous complaints of bureaucratic control, it is pleasing to note that there are two outstanding instances of official control which can be claimed to have justified themselves. The one is the appointment of the Electricity Commissioners, and the other the organisation set up under the Railways Act, for we are convinced that but for the fair and impartial manner in which the Railway Rates Advisory Committee has carried out its duties, we should not have found the railway companies quite so get-at-able as they have been lately. The happenings since the passing of the Railway Act have done much to bring the railways and industry into closer touch, and this should go a long way toward removing the anomalous state of affairs which too often exists in which the cost of freight within our own shores bears an altogether disproportionate relationship to the value of the article, quite apart from the considerations applying to export trade or competition at home with imported goods. As we have already mentioned, the present modification affects the charges now being made, but in connection with the new classification, which is almost complete, there is to be a new schedule of charges, the object of which, together with the classification, is to sweep away so many exceptional rates. It was the original intention to get rid of these altogether, but it was soon found to be impracticable, and when the new schedule of charges is published, it will be found that there are still some exceptional rates. This new schedule, however, will not come into operation for some time, as is evidenced by the agreement now made embodying an undertaking that no application shall be made for a general modification to come into force before July 31st, 1923.

A Call to Labour.

In the speech which Mr. H. Hirst delivered at the annual meeting of the General Electric Co., Ltd., on Tuesday, he was careful to dwell upon the important fact that the ill-effects of an industrial dispute are felt long after it has been settled between the parties immediately interested. The moulders' strike still exercises its baneful influence, as do also the coal trade disturbances, while the engineering lock-out has left consequences in its trail which will take some time to overcome. In this respect the speech is a great call to Labour to do its utmost to wipe out the consequences of our industrial disagreements. However efficient sales organisations may be, they cannot succeed if the productive side of the business is at a standstill or is going slow, or if purchasers are unable to place orders. There are many other reasons why manufacturing companies have not been able during the past year to give the same volume of employment, or distribute the same amount of profit, as formerly. We commend the speech to the careful attention of all our readers. The speaker, like other industrial leaders, does not anticipate a very rapid revival in the general trade in everything electrical, but he is, as he always was, an optimist in regard to the future of the electrical engineering industry, especially if the nation can be induced to see the necessity for supporting home industries.

THE NERVES OF THE NATIONS.

The Romance of the Submarine Cable.

By ROLAND BELFORT.

The forthcoming celebration of the Eastern Telegraph Companies' Jubilee has brought into sudden and well-merited prominence the world's submarine cable system. Never yet has the general public quite realised the universal scope and vital importance of what many eminent authorities consider the greatest scientific achievement of the nineteenth century. The conception of the cable will surely rank in the world's history with the discovery of gravitation, the discovery of America, the circumnavigation of the globe, and other epoch-making developments that have marked the world's progress.

The Cable as Federator.—From the Imperial standpoint, the cable has proved of fundamental importance. Certainly it has been a dominating factor in that problem of Imperial federation which, once a nebulous aspiration, became, during the Great War, a living manifestation of the unity and strength of the British Empire. Future historians will probably comment upon the curious fact that this framework of federation was mainly due to the first Sir John Pender, who happened to be a Manchester man, a Free Trader, and a prominent and active figure in those industrial and social circles where Imperial expansion was regarded with a certain suspicion.

There is no need to dilate upon the services rendered to the Press by the cable. Again, diplomatic and financial crises may now be generated with greater suddenness than formerly, but they are often averted with greater ease, thanks to the possibilities of instant cable intercommunication. As Lord Dufferin once remarked to me: "The cable has transformed the most distinguished Ambassadors into mere Foreign Office clerks, charged with the execution of the Foreign Secretary's orders." Problems that involved months for their solution are now solved in a few days. More than once the cable has averted the imminent danger of war between this country and certain others.

Famous Cable Pioneers.—While the cable has been developed by many brainy, farsighted men, British and foreign, it is generally agreed that the founders of the first Atlantic cable and, later on, the Eastern Telegraph combination's world-wide system, must be credited with the premier position among these hardy pioneers. For Sir John Pender and his associates persisted when others weakened; by their success they provided the British Empire and the world generally with a vital nervous system without which federation could not have come into being and so rapidly developed into the mighty instrument of civilisation which to-day excites the admiration—sometimes the envy—of the world. History is there to prove the unique services rendered by our universal cable system during the Great War, in rapidly rallying our scattered naval forces; transmitting our secret diplomatic instructions; facilitating the movements of British and Colonial troops; protecting our financial and commercial interests and everywhere maintaining British prestige and puissance throughout this mighty struggle.

The Cable's Influence on Finance.—Long before the war, the cable had revolutionised the world's commerce, reducing, in international dealings, the elements of uncertainty and risk; simplifying the complicated problems of international marketing; evolving world prices and the system of forward contracts. New markets were created and developed which, without the cable, would not to-day exist. The cable completely metamorphosed the Stock Exchanges of London and New York, creating in the former a distinctly American market, with a big volume of business. The Atlantic companies gave the arbitragists a five-minute service, as compared with the Government's one-hour service between London and Paris. Generally speaking, the finances of the world have been beneficially influenced by the cable; prices and values have been regulated with a precision and a delicacy never before known; London has been further strengthened in its position as the world's unchallenged financial centre. As for industrial and commercial affairs, the cable has facilitated and expedited these transactions—now conducted with a rapidity and a secrecy which have created new values and standards.

What a calamity for the world should certain omnipotent cable magnates suddenly decree the universal severance of this spinal cord of civilisation!

British Cable Supremacy.—Certainly, France, Germany and America have made, during the past twenty years, commendable efforts to exploit submarine cables on a limited scale, and they have also furnished some brilliant financial, diplomatic and administrative talent in cable enterprise. But it still remains true that, despite this laudable ambition and cordial co-operation, they have been compelled to depend mainly upon the British for their cables, repairing ships, scientific and mechanical equipment, and even for many super-smart operators. Thus the British may fairly claim that by their bull-dog pluck, capacity for "hanging on" against all odds, their inventive genius and financial daring they have contributed the lion's share towards the development of these nerves of the nations.

While the sun never sets on the British Empire, never can it rise without illuminating the ruddy, cheerful features of the ubiquitous cable expert—manager, electrician, or operator. "Follow the flag" is their motto. That means, of course, the tour of the world. In no profession is there greater need for personal devotion and initiative—qualities which have never been rare among our cablists. I have seen proofs of this in many countries, among the chiefs, the managers, the scientific staff, the men of the cable-laying and repairing ships, and also the general body of operators. "Carry on!" whatever the difficulty or danger. No riots, native risings, earthquakes, or cyclones; no cold, heat, or fever have ever been allowed to divert the cablist from his duty. In this attractive service, rich in romance, a resourceful mind, a capacity for prompt action, personal courage, aud an unflinching devotion to duty are the commonplaces of a profession in which are brought into play the finest qualities. There is no occasion to look elsewhere for the source of the success enjoyed by the cable since its inception.

The Men that Never Sleep.—For over fifty years the recorder "slip" has almost solved the problem of perpetual motion—countless thousands of miles of "slip" have been used in tracing the millions of messages flashed beneath the mysterious depths. Our sentinels of Empire

> " . . . . . unsleeping,
> While Earth rolls onward into Light,
> Through all the world their watch are keeping,
> And rest not now by day or night."

As a former cablist, now operating in another sphere, I record with pleasure that if the staff has developed this admirable loyalty and zeal it is largely due to the fact that the great captains of the cable have ever been constant in their solicitude for the welfare, comfort, and even the personal enjoyment of their men, wherever stationed. And, the more isolated or dreary the station, the greater their solicitude: generous salaries, ample leave, pension at 65, luxurious quarters, and every facility for rest, study, and recreation.

The young man fortunate enough to secure a cable appointment—not an easy feat, so attractive is the ser-

vice—and going abroad, may make sure of a hearty welcome everywhere. He always finds pleasant companionship, a fine mess, reading rooms, billiard rooms, cricket, golf, and tennis grounds, facilities for boating, and often a concert hall or theatre. Never is he really isolated. He gets the latest news from all parts of the world red-hot—often before his friends in England.

The Perfect Globe-Trotter.—Cablists explore the remotest corners of the earth in the practice of their profession. Every globe-trotter knows them; the more isolated the station the more hospitable its hosts. The cablist plays football or cricket in Cornwall, haunts the gay boulevards of Havre, Brest, and Marseilles, bathes in the Red Sea, and drinks of the waters of the Nile. He can go further East to Aden, Bombay, Zanzibar, Mozambique, or Madras; or to the Far East, anywhere between Colombo and New Zealand. Many placidly pursue the even tenor of their career in London, Penzance, Waterville, Valentia, or even Weston-super-Mare. Others are buried away in isolated spots like St. Pierre Miquelon, where they are popularly supposed to get nine months' winter and three months' fog, varied by a glimpse of the sun every blue moon! Some drag out a weary existence among the snows of Kamschatka or the reeking jungles of the Malaysian Islands. There are torrid stations in the Red Sea where it rains about once a year, and damp spots like Hong-Kong, where fungi grow in your boots during the night. Along the coasts of Africa and South America may be found horrible fever traps where the white man lives, as the Scotsman is alleged to joke, with exceeding difficulty. In the Far East there are also some very trying stations, planted on savage coasts and lonely islands far from the track of civilisation.

The Cablist Afloat.—One of the most attractive branches of the cable service is certainly that connected with the making, laying, and repairing of these precious links of civilisation. In no department of human effort is there anything more fascinating than the processes by which a big ocean cable is made, laid, and repaired. Such operations connote scientific and mechanical skill of no mean order; a gift for organisation and a talent for the management of men working under abnormal and even dangerous conditions. British pluck, resource, and ingenuity bordering on genius have seldom been developed and displayed to greater advantage than during these operations. In cable-repairing our men have always enjoyed undisputed supremacy. I have known several foreign experts who attempted this work, but their record was not brilliant. One not only failed to repair his own cable, but broke one belonging to another company. A certain foreign cable remained unrepaired for quite a year, because the company's ship could not raise it. On the other hand, British cable captains have scored some legendary successes. Although immense progress has been made in electrical science, cable-repairing still remains complicated, uncertain, dangerous work. The ship itself costs about £100,000; its maintenance in constant readiness for sea is expensive; then there is the element of luck. A steamer may leave harbour in brilliant weather; hook the broken ends of a cable, and effect a speedy repair. Or she may steam out of port in a howling storm or thick fog; fail to locate the cable; wearily drag the ocean for weeks without getting a "bite." Even if the cable be hooked, it may rise almost to the surface, suddenly snap and "swish" into the sea with a thud which sickens both technicians and navigators. The "Anglo" Co. once spent about £95,000 and quite a year in repairing one of its cables. Atlantic cables are broken by ships' anchors, icebergs, whales. Four cables were once broken simultaneously by a terrible "seaquake."

When it is considered that repairing operations involving the most intricate navigating manœuvres, mechanical feats and delicate electrical experiments are conducted in mid-ocean, during stormy, foggy weather, right in the track of ocean flyers or icebergs, its dangers can be readily understood. Yet accidents are not frequent; repairs are usually promptly effected; all hands work zealously by day and by night. One cable engineer, seeing the cable fouled by the propeller, jumped into the sea and cleared it, although sharks were cruising around. Such incidents are fairly common. This holy zeal explains the success of cable-repairing despite tremendous difficulties, disasters, and disappointments.

Foreigners as Cable Experts.—Foreigners envy us this universal cable system, which makes of London a vast gramophone, registering and announcing almost simultaneously every important event as it occurs. To us must the world look for the latest news, for we usually get it first, and act as a sort of news clearing house for all other nations, especially in shipping, Lloyds having a wonderful service from all parts of the world. Thus, not only does Britannia rule the waves, but she also controls the ocean depths.

Men of many nationalities are engaged in cabling, but only in limited numbers, and they rarely equal British operators in either speed or accuracy. Even American cable companies usually employ British operators, their telegraphists, although extremely clever, never having quite caught up with us in cable telegraphy. My experience is that the foreigner, apart from the American, fails to appreciate the immense importance of *speed* and concentration in a profession wherein "rush" is the essence of the contract. "To-morrow will do." However, in this respect, they are now making considerable progress, stimulated by the example of the British, in cable-making, laying, and working.

Evolution of the Cable.—When, in 1851, Brett submerged his first 25 miles of cable beneath the waters of the Straits of Dover his audacity was regarded as more than the freakish exploit of a madman—the scheme was described as a veritable swindle, engineered by some greedy London promoter. That cable pioneer never dreamed that this "swindle" would develop into a vast, universal industry with about 330,000 miles of cable; an army of 25,000 men; a fleet of over forty ships, vast establishments and valuable real estate all over the world. Brett, who experienced such difficulty in raising his modest capital, would have marvelled at the £60,000,000 now invested in cable enterprise, and the imposing array of financial, scientific, and administrative talent now engaged in maintaining and developing this magic "girdle round about the earth."

The Pluck of the Pioneers.—No estimate of the cable position can be practical or equitable unless special consideration be accorded to the fact that the world's cables have been financed, manufactured, laid, repaired, and worked by brainy, resolute, resourceful capitalists and scientists, notably the Penders and their associates in all departments. They firmly believed in the potentialities of submarine cables from the outset, when sceptics were in the majority. Generally speaking, this grand work has been done without much British Governmental support. In the early days no Government would have undertaken such risky, uncertain, novel work. When the pioneers stepped in where our State mandarins feared to tread, the general public rather scoffed at them as visionary enthusiasts, "eager to throw their money into the sea." Disraeli nicknamed Pender "John Spender." For, when irretrievable failure threatened the second Atlantic cable, and other capitalists were sick and weary even of the word "cable," John Pender pluckily saved the situation by his personal guarantee of £250,000. Such superb confidence naturally inspired hope and emulation and stamped John Pender as a leader of men—a financier of exceptional daring.

(To be concluded.)

Light Without Heat.—Demonstrations of a device for the production of "cold light," which were recently given before a group of international scientists by Mr. M. J. Ritterath, a Los Angeles inventor, have aroused great interest in the American kinema world. "Cold light" is claimed to be pure white and so free from heat that even highly inflammable films can be subjected to it for hours without fear of burning.—*Evening News.*

CALCULATING CURRENTS IN A MESH-CONNECTED THREE-PHASE CIRCUIT.

By ALFRED STILL,
Professor of Electrical Design, Purdue University, Indiana, U.S.A.

Although the following graphic solution of a three-phase problem is remarkably simple, the writer has no knowledge of its having been published.

Problem.—Given the magnitude and phase relations of the three line currents supplying a three-phase mesh, calculate the magnitude and phase relations of the currents in the mesh.

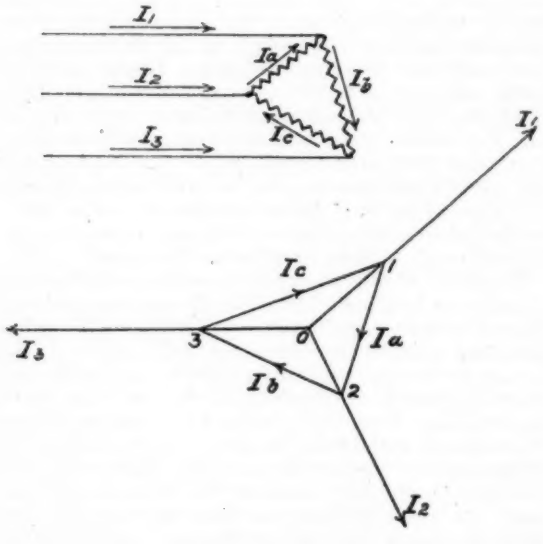
Graphic Solution.—Draw the vectors $o1_1$, $o1_2$ and $o1_3$ to represent in magnitude and phase the three line currents shown in the diagram of connections. Locate the points 1, 2, and 3 on these lines, so that—

$$\begin{aligned} o1 &= \tfrac{1}{3}\, o1_1 \\ o2 &= \tfrac{1}{3}\, o1_2 \\ o3 &= \tfrac{1}{3}\, o1_3 \end{aligned}$$

and draw the triangle 1, 2, 3. Then—

$$\begin{aligned} 1, 2 &= I_a \\ 2, 3 &= I_b \\ 3, 1 &= I_c \end{aligned}$$

where I_a, I_b and I_c are the currents in the three branches of the mesh, as indicated on the diagram of connections.



Proof.—Since the vectorial addition of the three currents in the mesh must be zero, we have—

$$\dot{I}_a + \dot{I}_b + \dot{I}_c = 0 \quad \ldots \quad \ldots \quad (1)$$

From the diagram of connections it is seen that—

$$\dot{I}_2 = \dot{I}_a - \dot{I}_c \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

and

$$\dot{I}_1 = \dot{I}_b - \dot{I}_a \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Subtracting (3) from (2), we have—

$$\dot{I}_2 - \dot{I}_1 = 2\,\dot{I}_a - (\dot{I}_b + \dot{I}_c),$$

but it is seen from equation (1) that—

$$\dot{I}_b + \dot{I}_c = -\,\dot{I}_a,$$

whence

$$\dot{I}_2 - \dot{I}_1 = 3\,\dot{I}_a,$$

and

$$\dot{I}_a = \frac{\dot{I}_2}{3} - \frac{\dot{I}_1}{3}.$$

It is obvious that similar expressions will be obtained for the currents I_b and I_c.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

The Annual Convention at Wolverhampton.

Sub-station Equipment including Automatic Control.

By R. A. Chattock,
City Electrical Engineer, Birmingham. (*Abstract.*)

(*Concluded from page 64.*)

Automatic Operation of Sub-Stations.

The apparatus should be designed to automatically control the starting and stopping of the sub-station plant, as required by the demands of the system. For a single unit feeding into a network the control is effected by the pressure of supply on the line. When this falls to a pre-determined figure owing to the increased demand, a relay is operated which starts the sequence of operations which start up the unit of plant.

For a number of units feeding into a network it would appear that the control would be better determined by the amount of current that is being supplied from the group, individual units being cut in when this rises to a pre-determined amount and cut out again as it falls.

In each case it is advisable to allow a time lag of about five minutes before the control actually operates, in order to allow for temporary variations which can be satisfactorily met by the plant on circuit for short periods. This applies especially to automatic sub-station plant used for traction purposes.

For the rotary converter the controls are numerous and complicated. In the case of an induction motor-generator a number of these devices can be dispensed with. In the case of the mercury arc rectifier, some of the protective devices, such as heated bearing control, field regulating control, &c., could be still further dispensed with and the automatic arrangements simplified in consequence.

Since July, 1921, the Birmingham electric supply department has had a trial mercury arc rectifier running at the Harborne sub-station, and has developed an automatic system of control which has been in operation for some months with entire satisfaction. The rectifier is run as a single unit in parallel with the storage battery, and is left in circuit day and night. Should a serious overload or external short circuit occur, the apparatus automatically cuts out, and the automatic starting mechanism comes into operation, first closing the a.c. oil switch, then striking the mercury arc in the cylinder, and closing the direct-current switch. Shoulr the external trouble still be on, it trips out again, and this is repeated three times in all, after which the apparatus is cut out permanently.

The load on this sub-station does not require more than one set at a time in parallel with the battery, so that it has not yet been necessary to develop the starting and stopping arrangements controlled by the total load going out from the sub-station. These can, however, be added when required.

The apparatus is left on circuit and the attendants are withdrawn from the sub-station at night time and at week-ends, the station being run as a two-shift station.

The automatic apparatus was thoroughly tried out for a considerable time on external resistance load, and was found so satisfactory that it was put on circuit and the staff eventually cut down.

The remainder of the paper is devoted mainly to typical sub-station lay-outs.

The cost of a sub-station containing rotary converter plant of 4,000 kW capacity, with a battery, is given as £79,732, and with an annual converted output of 9,200,000 kWh. the working cost per kWh sent out is 0.356d. A static transformer sub-station of 50 to 100 kW costs £6 per kW.

For power-factor correction, on a 25-cycle circuit, the cost of condensers is £9 9s. per kVA, and of Kapp vibrators £3 12s. per kVA.

Discussion.

Mr. S. J. Watson (Bury) said that a speed of 500 r.p.m. was sound practice a few years ago, but now 1,000-kW rotaries were running at 1,000 r.p.m., consequently costing less, and having a slightly higher efficiency. Prices generally had fallen rapidly since the date given in the paper, and today a complete rotary equipment cost less than £4 per kW. Self-synchronising rotaries had advantages; they could be run up and put on load within half a minute. They were also far less sensitive to short-circuits on the high-pressure side, which threw rotary converters out of synchronism. With regard to the comparison between a.c. and d.c. distribution, Mr. Watson thought the former far the better; the only advantages of d.c. were the use of batteries and the facility for regulating the speed of motors.

Mr. S. E. Fedden (Sheffield) said it was quite impossible to give a cheap and abundant supply of electricity on a large scale on the systems advocated in the paper; the capital outlay was very large. A cheap supply could be given only by the static transformer system, which also overcame the difficulty of voltage regulation. In Sheffield they used concrete for sub-station buildings and ironclad switchgear; the whole building cost only £150. No kiosks were used, the same construction being suitable on a small scale, and 11,000

volts could be handled without difficulty. A 1,400-kW a.c. sub-station cost only £2 or £3 per kW. Batteries were out of the running. In Sheffield the power factor was poor at slack times, but when the town got busy it improved at once. Individual cases of low power factor were dealt with separately.

Mr. W. H. ALABASTER (Melbourne) expressed his pleasure at attending the Convention, and remarked that the corresponding association in Australia was smaller in number, but the members had ten times as far to travel. He gave particulars of the sub-station practice of Melbourne, being in general agreement with the author of the paper. In an area of 2,000 by 1,250 yards the d.c. load amounted to 12,000 kW; he was installing a new sub-station with three 2,000-kW rotary converter sets, but without a battery. He thought that 0.356d. per kWh was an appalling cost; perhaps it was partly due to the use of a battery. He was using a 5,000-kW frequency changer, 50 to 25 cycles, for railway supply, and a 12,000-kW set was on order for the Victorian Government.

Mr. R. B. MITCHELL (Glasgow) agreed with the first two speakers, and regretted the necessity of supplying direct current. He thought that batteries in sub-stations were not justified, on account of the cost. A 1,500-kW mercury arc rectifier with three cylinders had been installed at Glasgow; difficulties had been met with, but would be overcome by the makers in time. They were using 25-cycle current for lighting in spite of the flicker. He approved of power-factor correction, and had found Kapp vibrators satisfactory.

Mr. R. L. MORRISON (Brown, Boveri & Co.) said that his firm had produced satisfactory rotary converters to work at 1,500 volts, 50 cycles. Seven designed for the Midi Railway were to have a continuous output of 750 kW, but in view of their overload capacities they were really normal 1,200-kW machines. The two-hour rating was 1,125 kW, and the five-minute rating 2,250 kW; the no-load pressure had to be 1,650 volts, and the speed was 750 r.p.m. The no-load losses, on the 1,200-kW basis, were 2.75 per cent. The specification required the machines to withstand five consecutive short-circuits at one-minute intervals; in fact, 60 short-circuits were applied to the first machine at that rate, and the set stood up to the test perfectly, 150 short-circuits being applied in all. Flashing was almost absent, and no flash-barriers were used. On the 1,200-kW basis the efficiency was 95 per cent. at full load, 93 per cent. at half-load, and 89 per cent. at quarter-load.

At this point the discussion was cut short, and Mr. R. A. CHATTOCK, in reply, said that reliability was of supreme importance, even at greatly increased cost. That was a guiding principle in Birmingham—hence the use of batteries, which were a necessity for maintaining continuity of supply. They were rated at 20 to 30 per cent. of the capacity of the plant in a sub-station and carried on while the plant was restarted after a mishap. In Birmingham the power factor was gradually falling; the tariff was on the kW basis, and it was difficult to change to the kVA one, so that they would have to face power-factor correction themselves. For a certain small section of the area a 1,500-kW frequency-changer was being installed. The cost stated for the battery sub-station did not include that of the building. Their one-cylinder 250-kW mercury arc rectifier gave no trouble, working in parallel with other plant, and offering no difficulty in regulation.

Mr. R. L. MORRISON, who was asked to forward his remarks for publication in the *Proceedings*, informs us that below half-load the rectifier shows to advantage, because its quarter-load efficiency is usually within 1 or 2 per cent. of that obtained at half-load. Moreover, the efficiency improves in course of time. The smallest rectifier manufactured is a 300-amp. size, which, at the basic pressure assumed by Mr. Chattock, would give 150 kW. This is an extremely satisfactory size; one is installed at Ipswich, and several hundred are at work on the Continent. With regard to rectifier prices, full allowance should in fairness be made for the saving effected as regards attendance. Where new sub-stations have to be erected a light corrugated iron structure or an existing building can be utilised, and if this is done the figure indicated for automatically operated sub-stations complete will be below that of similar rotary converter sub-stations. It is admitted that Mr. Mitchell has had some trouble with one of his three cylinders; the other two are working quite satisfactorily, and have been taken over by his department. These troubles are "diseases of infancy," and only occur in a small percentage of cases, and then almost without exception during the first few weeks of operation until the anodes are "formed."

Of sixteen sets in hand for the Midi Railway each has a continuous output of 1,200 kW at 1,575 volts d.c., and has to fulfil the same conditions as the seven rotary converters referred to above. Recently a standard high-pressure rectifier was operated for 70 consecutive hours at 3,500 volts d.c. with a load of 250 amps. So satisfactory were the results that the d.c. pressure was raised to 5,400 volts, and a further continuous run was maintained for 24 hours with the same current. The rectifier functioned perfectly, there being no tendency whatever to internal flashing-over. To prove the suitability of the rectifier for extra-high-pressure d.c. traction conditions it is proposed to install a trial equipment on one of the Italian railways at 4,000 volts d.c.

Some nine months ago Messrs. Brown, Boveri, at their own expense, put into operation a trial equipment operating at 1,600/1,700 volts on the Bernese Overland Railway. The rating of the set at this pressure is about 850 kW, while the load is of an extremely variable nature. Throughout this period it has worked without a hitch, and having completed their trials the makers were desirous of removing the equipment, but the railway authorities would not hear of this, and have agreed to purchase it outright. One very important advantage for high-pressure d.c. electrification is that whereas rotary converters must be placed in fairly large sizes in sub-stations located a fair distance apart, with the rectifier it is possible to utilise much smaller automatically-operated sets in cheap sub-stations at short intervals along the line. The saving that will be effected in copper alone is considerable.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Where are the Wiremen?

I have had the greatest difficulty in getting a young man suitable for general work in a small supply station in the south. The duties consist of small wiring jobs, overhead line work, and making himself useful generally in the station and outside. I have had nearly 200 applications on each occasion I have advertised, and so far I have not been able to get a man who can wire a job of a few lights without getting it all mixed up and necessitating my testing out and correcting it myself.

With so many out of work one would think it was an easy matter to find a suitable man, but I have not found it to be so, and I shall be glad if any of your readers who know of such a man can personally recommend him to me.

I may add that I have an excellent staff, and it is getting this one extra man that seems so difficult. I may also add that mine being a small station I am naturally not offering some of the extraordinary wages asked by some of the applicants; at the same time I am offering a very good figure for a constant job for a handy man.

Engineer.

July 12th, 1922.

The I.E.E.'s Outlook.

I agree with Mr. E. Kilburn Scott's contention, as expressed in your issue of May 26th, that the Institution would gain if the oversea dominions were represented on the Council. The chairmen of Local Centres abroad are *ex-officio* members, but they are seldom in London to attend a meeting and are completely unknown to the majority both of the members and of the Council; *ex-officio* membership, in fact, is merely a rather empty honour to the man, and of no use whatever to the Institution. Overseas trade is of vital importance to electrical engineers professionally, but the great majority of the members of the Council are and always have been distinguished engineers connected for most of their lives with some one undertaking or business in the United Kingdom. The fact remains that if any of us unknown returned wanderers were put up for election to the Council we should not get a score of votes.

J. W. Meares.

Simla, India, *June 19th*, 1922.

The I.E.E. Wiring Rules.

It was pleasing to notice that, according to the report contained in your last issue, the question whether powers should be sought to enable electricity supply authorities to make the observance of wiring rules compulsory to contractors was raised at the I.M.E.A. Convention.

The carrying of a motion to bring the matter to the notice of the Electricity Commissioners makes it clear that this Association recognises the importance, not only of securing a greater margin of safety for the community, but also of placing the future of domestic wiring on a sound footing.

The development of such a step would, it is ventured to suggest, greatly help to raise the status of this branch of the industry, and the problem should, therefore, receive the very careful attention of all those whose calling connects them with it.

The present position is far from satisfactory. Whilst it is true that most undertakings have framed certain rules and regulations for the guidance of local wiring contractors, to which the latter are expected to adhere, much controversy exists in some quarters as to whether the suppliers concerned are entitled to enforce them either wholly or partially (with the possible exception of those few who hold special statutory powers), and to those whose business it is to test and connect installations, and to adjudicate upon matters arising therefrom, the introduction of a definite ruling would be welcome.

The general acceptance and adoption of the I.E.E. rules would, undoubtedly, tend to raise the standard of domestic wiring in no small degree, and should result in mutual benefit to both suppliers and contractors alike, inasmuch as the former would be saved a deal of anxiety and annoyance, and the latter would have the advantage of being in a position to uphold their reputation for good work without fear of being undercut in price by a less conscientious competitor.

Again, for a contractor carrying out work up and down the country, the matter of making himself acquainted with the particular requirements of a certain undertaking may have been overlooked, with the result that, unless it happens that an official of the latter happens to come on the job during erection, nothing is known until the installation is ready for connection, and this fact often leads to delay in completing the work.

It is not suggested that it is possible to lay down hard-and-fast rules which would be adaptable in every instance, as many factors are entirely dependent upon local conditions, but it is maintained that many clauses could be so compiled as to eliminate much uncertainty. The writer has experienced instances where failure on the part of outside wiring contractors to make themselves familiar with the particular requirements of the local undertaking has resulted in considerable inconvenience to all concerned.

In point of fact, it is well to bear in mind that, strictly speaking, the suppliers have no dealings with the contractors at all; *their business is to supply electrical energy to the consumer*, and, in consequence, they must approach him direct on all matters relative to work being carried out on his premises, and this only makes the position more complex.

It would be interesting to have the views of others on this subject.

J. R. Willingham.

Llanelly, *July 11th*, 1922.

Where are the Young Men of the I.E.E.?

The experiences of "Younger Member" apparently have been unfortunate.

Such experiences are, I am convinced, very rare. Certainly the students and graduates attached to the Scottish Centre cannot complain of "the lack of recognition and encouragement by senior members of the Institution." My own experience is that Scottish members do their utmost to encourage the younger members, and that they rigidly exclude any atmosphere of stiffness from their meetings.

At the recent summer meeting in Scotland the honorary secretary and the Committee of the Scottish Centre were untiring in their efforts to make the younger members, especially those who were strangers to Scotland, feel at home and among friends.

The friendly spirit of the seniors towards the juniors is, to my mind, an outstanding attribute of the Institution, and I feel sure I am not alone in that opinion.

In conclusion, may I suggest that junior members who feel that they are out in the cold should help to solve their own difficulties by going to the meetings with an open mind unhampered by the belief that they are going to be treated in a "superior" manner.

Duncan J. McKellar.

Glasgow, *July 11th*, 1922.

Careful perusal of some of the letters concerning the above question from certain of your correspondents seem to convey clearly that they have entirely overlooked the objects of the I.E.E.

Such associations as the A.M.E.E., the S.T.E., and the E.P.E.A. are doing their utmost to set a "first-class profession" upon a first-class basis, as far as salaries and status are concerned.

The I.E.E. is essentially not a "wage wrangling" body, and it is particularly desirable, in the interests of all classes, that it should not be so.

It is quite possible that some members can prove certain isolated instances, such as those mentioned by one or two of your correspondents, but I feel sure that these matters could have been soon rectified, had the proper channels been explored.

The question of securing better positions leads to the matter of applications, and I was particularly interested in a leading article in *Engineering* on June 2nd, 1922, entitled "The First Step," as I consider that some home truths were very vividly brought out therein.

The writer of that article, amongst other things, stated that "the task of the advertiser is not so much that of selecting one candidate as of finding reasons for rejecting one hundred and ninety-nine. By the time he has thrown aside all the illegible letters, the misspelt letters, the undated letters, and the ill-constructed discursive letters, often covering several pages which do not read consecutively; the letters which do not give the age of the applicant, or which fail to state how he acquired the experience which he claims; those which do not say when he could take up his duties, if appointed; those which say the candidate would like to have more particulars of the job before he can state the salary he would ask, and all the other letters which for various reasons are unattractive or hopeless, the remainder, destined for serious consideration, will usually be very few in number. A man who scribbles or misspells in a letter of application is likely to be equally illegible and perfunctory in actual work. Those who do not trouble to put a date on their letters are rejected not so much because they have omitted a date, as because they are the sort of people who omit dates on records; again, a man who cannot state his own qualifications clearly, fully and concisely, shows himself deficient in the art of clear thinking and the orderly marshalling of facts in his mind."

It is unfair to expect any chief to "push" a man on just because he has one qualification; the desirable chiefs are those who consider *all* qualifications, and judge accordingly. Many young men would do much better if they considered some of the above remarks of those who deal with applications.

Kenneth Pittaway.

London, *July 15th*, 1922.

Proposed Emigration—New Zealand.

I have just read Mr. Allan's advice to "Inquirer" to proceed at once to New Zealand, in the Electrical Review of February 24th. It would seem that Mr. Allan has not first-hand knowledge of this country, yet is most enthusiastic in its praise. Well, I really believe it to be a better place to live in than England, although the 70 in. rainfall is rather a drawback, but things are so bad here that I would advise "Inquirer" to wait awhile. Perhaps in 100 years New Zealand may be a rival to England as a manufacturing centre; just now it is that much behind. We have a trifling debt of nearly 200 millions, and I notice Mr. Allan thinks "able finance" would help us. Personally, I think finance is just a little bit too able sometimes. However, to come to the point, a man wants to be really keen on hard work to do any good in New Zealand. If he is a real "top notcher" let him stay away. There are more openings in England for such men. If Mr. Allan, however, means by "skilled worker" an artisan who knows his work, there are plenty here already, and lots looking for jobs just now. That fact need not prevent "Inquirer" coming, as doubtless the country districts will presently need such men with the coming of hydro-electricity. This is slow, and the large scheme that is to supply Auckland is to be in operation in five years, perhaps. That is contingent upon this magic "finance."

By the way, "Inquirer" must be prepared to do a job of navvying if required, or lend a hand jacking logs, or shovelling coal. The writer 14 years ago loaded limestone into railway trucks, and once sawed off 16 in. square piles below water well off shore in a northern harbour. Such trifles as putting new boards into the bottom of water races three miles into the bush at 2 a.m. in a gale, with 4 ft. of water running, must not daunt "Inquirer." If he has pluck enough to do these jobs he will be better in New Zealand, but if he can earn a living easier where he is, let him stick to it.

Ex-Londoner.

Auckland, N.Z.

REVIEWS.

Artificial Light. By M. Luckiesh. Pp. x+366; 42 illustrations. London: University of London Press. Price 12s. 6d. net.

At the outset it must be stated that the author has endeavoured to provide for the general reader and not for the technician; nevertheless, the book is comprehensive and one is enabled to follow closely the march of civilisation through the ages on account of the assistance given to educative and creative work by the gradually improving lighting conditions. The development of the various materials and apparatus used for the production of illumination is fully covered, so that the specialist in any of the particular branches of the art is able to obtain a wide outlook and at the same time can appreciate the great fields covered in other directions by his brother specialists.

After a chapter dealing with the subject in a summary and abstract form, the writer turns to the art of making fire as carried out by primitive man, showing the progress made up to the present time; this leads to the consideration of the early light sources, the multiplicity of devices used is striking, and one is reminded that there are to-day many peoples who are still dependent upon light sources similar to those used by our forefathers. The pages devoted to the ceremonial use of light indicate the close connection between religion and our subject in both Christian and pagan rites.

We then proceed to the more modern units, the oil lamps of the nineteenth century being first dealt with, when more technical matters begin to appear and assist one in making interesting comparisons. Early gas lighting follows and one can appreciate the difficulties encountered by the pioneers. Before modern apparatus and means are arrived at the

author treats us to a chapter on the science of light production, and introduces the non-technical reader to scientific terms and definitions; from the reading thereof he should be able to estimate the relative efficiencies and possibilities of the various sources available. The chapter on modern gas lighting impresses one with the rapid advancements made during the past hundred years, but still more striking is the history of electric lighting, covered by the next two chapters. Naturally enough, the writer treats of the progress on the American side probably more fully than the European, and items with which he has been in close contact are mentioned at length, although in this country they may not have met with any success whatever. Interesting figures indicate the increase in the standard of lighting during the last decade. The embryo inventor can glean much from the next pages directing attention to the future, which completes the story from the production point of view.

The purposes to which light is put occupy the remainder of the book; again we are led through the historical sequence so that we may better understand the why and the wherefore of present day practice. Street lighting, lighthouses, the use of artificial light in warfare, and signalling are the headings of consecutive chapters, and the matter is sure to be of interest even to the specialist. In these days of economy the pages dealing with the cost of light should prove a source of thought, though to the English reader the American values and costs may be misleading, owing to the very different conditions prevailing in the latter country. Somewhat similar remarks apply also to "Light and Safety" and "The Cost of Living." The chapters on "Artificial Light and Chemistry," and "Light and Health," contain much that may be novel to many readers, but it is noteworthy that the author passes quickly over the latter subject, calling attention only to those applications of proved merit.

"Modifying of Artificial Light" naturally leads one to spectacular lighting, and to English readers the employment of light for decorative purposes as carried out in the States will come as a revelation. The abstract is covered by the title "The Expressiveness of Light"; church lighting is here touched upon, as is also stage lighting. To those who may have been surprised at recent exhibitions on the London stage, it may not be out of place to point out that Mr. Luckiesh himself claims credit for suggesting such methods a number of years ago.

After useful hints relative to home lighting, the book closes with a plea that lighting should be considered as a fine art, a plea, which in our opinion, is justified; though we much regret that in this country conditions are, as yet, much behind those to be found across the Atlantic.

Handy reading references are given and there is a good index, the illustrations are well selected, and should prove educative to the average reader. We are well satisfied that a thorough reading of the work amply repays one, and we trust that it will meet with the success it deserves.

The Electro-Deposition of Copper and Its Industrial Applications. By CLAUDE W. DENNY, A.M.I.E.E. Pp. xii+108; figs. 29. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

This is one of the volumes in that excellent series "Pitman's Technical Primers," and, like some of its companions which we have read, is characterised by the author's skill in compressing an astonishingly large amount of useful, practical information into an exceedingly small compass.

Before the war, industrial applications of electrolytic copper deposition, apart from electro refining, were practically confined to the production of electrotypes for printing blocks and plates and, to a less extent, of art metal work. Now, however, there are many uses of deposited copper which are of considerable interest to the ordinary engineer, and the author of this book deserves our thanks for having drawn attention to them. One such use is in reinforced steel sheets where copper is deposited on and into perforated steel. Reinforced copper tubes are also now made, and many applications of these materials are suggested or will occur to the reader. Electro-deposited, jointless radiators for internal combustion engines are also now made, and they offer an obvious advantage over the built-up radiator, with its multiplicity of joints. Another interesting application of copper deposition is for the production of gramaphone records, and we wish the author could have found space to give more details of this art. An application which appears to have been overlooked is the case of certain aero engine details where copper has been deposited successfully as a protection against carburisation in parts adjacent to those requiring case-hardening, as a means of improving heat conductivity and for building up definite constructional details. Capt. Thain read a paper on this subject last year at Sheffield at a joint meeting of the Institute of Metals and the Faraday Society.

Apart from describing the above and other applications of copper deposition, the book includes some well-written, if highly-condensed, chapters on the process of deposition, including very useful sections on the testing of solutions and the lay-out of plant. Attention is rightly drawn to the necessity of circulating the solution in most, if not all, cases of deposition. It would have been well to add a warning as to the harmful effect of accumulated impurities—and especially those of an organic character—on solutions which have been used for long periods without purification, mechanical and chemical, more particularly where copper of high tensile strength is required.

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XC. of the ELECTRICAL REVIEW, which is now being printed, will be supplied only to those who through the post specially apply for it. To them it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—JOSEPH R. T. NORRIS, trading as Acme Electrical Co. and residing in Warley Road, Blackpool.—At Blackpool County Court on July 12th a receiving order was made. Judgment had been obtained in the High Court by Millo Co., Oldham. Liquidator: Mr. A. C. Hanson, of Oldham.

BELL, J. B., electrical engineer, 21, North Bar Within, Beverley.—Trustee (Mr. E. P. Dutton), released, March 17th, 1922.

LESLIE BROWN, The Street, Frensham, Surrey, electrician.—The following are creditors herein:—

	£		£
Fairbank, Dr.	70	Robertson, A. M.	60
Ayling, W.	30	Johnson & Phillips	25
Haskell, J.	25	Berridge, F. W.	40
Milsum, W. S.	38	Wright, A. E.	70
Mackenzie, Miss	72		

PHILLIP MARSDEN ROGERS, trading as the Longbridge Engineering Co., Great Darkgate Street, Aberystwyth, electrical engineer.—The following are creditors herein:—

	£		£
Clarke, George	14	Nico, Ltd.	12
Ewins, Ltd.	15	Owen, Richard	26
Hart Accumulator Co., Ltd. ...	14	Swinburne, T. H. M.	22
Jenkins, Edward E.	22	Snelling, George	95
Jenkins, D. Lloyd	20	Wolsley Sheep Shearing Machine	
Bankers	60	Co.	36
Mealand, E. H.	200		

T. R. W. WYNESS (Wyness & Bale, electrical engineers), 13, Commercial Street, Brighouse.—Trustee, Mr. C. H. Baker, 1, Albion Street, Leeds, appointed July 12th.

A. J. WILCOX, motor and electrical engineer, The Garage, Farnham Common, Bucks.—Last day for proofs for dividend July 29th. Trustee: Mr. F. W. Davis, 28, Theobald's Road, Bedford Row, London, W.C.1.

Company Liquidations.—ELECTRICAL INDUSTRIES, LTD., 9-10, Pancras Lane, London, E.C.—July 31st is the last day for receipt of proofs for dividend by the liquidator, Mr. H. E. Burgess, 33, Carey Street, London, W.C.2.

SPECIAL PRODUCTIONS, LTD.—Meeting August 17th at 22, Cooper Street, Manchester, to hear an account of the winding-up from the liquidator.

BETA BATTERIES, LTD.—Winding up voluntarily. Liquidator, Mr. J. Cameron. Meeting August 16th at 5, New Court, Lincoln's Inn, W.C.2, to hear an account of the winding-up.

PLANET ELECTRIC CO., LTD.—Meeting, August 25th, at 67, Broad Street Avenue, London, E.C.2, to hear an account of the winding-up from the liquidator, Mr. S. H. Swallow.

Scheme of Arrangement.—WESTMINSTER ENGINEERING CO., LTD., Victoria Road, Willesden Junction.—Meetings of the different classes of shareholders are to be held, by order of the Court, on July 27th to consider a scheme of arrangement between the company and themselves.

Dissolutions of Partnership.—MEADOWCROFT & WHITTAKER, consulting engineers and merchants, King Street, Manchester.—Messrs. S. Meadowcroft and J. B. Whittaker have dissolved partnership.

J. L. ELECTRIC CO., electricians, 30, Church Street, Birmingham.—Messrs. L. C. Hickson and A. Quaife have dissolved partnership.

C. GALLOWAY TAYLOR & CO., electrical engineers, Bright Street, Leicester.—Messrs. G. Adcock, H. Shipley, and C. Galloway Taylor have dissolved partnership.

Trade Announcements.—MR. W. GRAHAM, late of the Edison Swan Electric Co., Ltd., has been appointed resident engineer and local manager of the Malacca Electric Lighting Co., Ltd., which is opening a new contracting branch in conjunction with its supply business. He desires to receive catalogues, price information and samples. These should be addressed to the company at Kabu Road, Malacca, Straits Settelments.

MR. GRAHAM M. STEVENSON, M.I.E.E., M.I.Mech.E., of 136, Yardley Wood Road, Moseley, Birmingham, has been appointed sole representative in Birmingham and district for Messrs.

T. W. Broadbent, Ltd., of Victoria Electrical Works, Huddersfield, manufacturers of generators and motors, switchboards, &c. Mr. Stevenson will devote himself more particularly to the application of electric driving to rolling mills. He was personally responsible for work of this nature at the Redbrook Tinplate Works, near Newport, Mon.

Catalogues and Lists.—MESSRS. W. H. A. ROBERTSON AND CO., LTD., Lynton Works, Bedford.—An illustrated catalogue of air compressors, vacuum pumps, compressed-air reservoirs, and dessicating sets.

MESSRS. H. T. BOOTHROYD, LTD., Bootle, Liverpool.—Stock list of d.c. motors and generators.

MESSRS. BUCK & HICKMAN, LTD., 2, 4, & 6, Whitechapel Road, E.1.—An illustrated brochure dealing with automobile gears manufactured by E. N. V. Motors, Ltd., an associated firm.

ELECTRICAL INSTALLATIONS, LTD., 27, Martin Lane, Cannon Street, E.C.4.—A well-produced brochure illustrating examples of the firm's work, and including views of factories of various types, country houses, churches, and other large buildings.

STERLING TELEPHONE & ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W.1.—Publication No. 324, a priced and illustrated leaflet advertising the Sterling "No 1" crystal w.t. receiving set.

MESSRS. THOMPSON & CO., 48, Watling Street, E.C.4 (agents for the Société Industrielle pour la Fabrication d'Appareils de Mesure, Paris).—A well-illustrated descriptive catalogue of switchboard instruments, including voltmeters, ammeters, synchroscopes, p.f. meters, frequency meters, &c.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list of d.c. motors, &c.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—List No. A/23, a comprehensive catalogue of electrical goods, including wireless apparatus, electro-medical sets, X-ray equipment, instruments, telephones, switches, lighting fittings, &c. Fully priced and illustrated.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—List No. 952, giving particulars, illustrations, and prices of the new pattern "Diaduct" distribution boards.

MESSRS. W. H. SUGDEN & CO., LTD., Glenny Road, Barking.—Stock list of electric motors, d.c. and a.c., of various makes.

MESSRS. HARDY & PADMORE, LTD., Worcester Foundry, Worcester.—An illustrated catalogue of cast-iron work, including feeder pillars, transformer kiosks, lamp standards, frames and covers, &c.

"Underground" Advertising.—The "Underground" combine continues to publish fresh pictorial posters advertising its system and adding to the appearance of its stations, &c. We have received a copy of the latest of these posters depicting a highly-coloured animal, which we understand to be a *Cercopithecus Mona*—the object being to entice travellers to go to the "Zoo" by the electric railways.

The Empire Exhibition at Wembley Park.—We are not yet provided with much information respecting the progress made with the arrangements for the electrical exhibition which is to take place at Wembley Park in 1924. More activity is apparent with regard to the shipbuilding, marine, mechanical, and general engineering sections, the organisation of which is in the hands of the British Engineers' Association. On Thursday last week the president of the B.E.A., Mr. N. G. Gwynne, and the Council of the Association paid a visit to Wembley PARK to inspect the progress that is being made in the preparation of the site and the erection of the Exhibition buildings. Not unnaturally, this gives rise to comment on the part of some who have the general engineering invitation before them, but who wish to know the electrical details before they lodge their space inquiries with either committee. We hope to be in a position to publish something official on the subject before long, but in the meantime perhaps our readers can glean some information from the following quotation from the *Electrical Contractor* for July:—

"The year 1924 seems a long way off, but it is going to be such a busy time for the electrical industry that plans cannot be prepared too soon. The Institution of Electrical Engineers contemplates a National Electrical Convention in that year. 1923 was first thought of, but the postponement of the British Empire Exhibition induced the I.E.E. Council to choose the later year for the first big all-Association gathering. The contractors will have their part to play in that enterprise; and they will also, we hope, have some function to perform in the display which the electrical industry will make at Wembley. The British Electrical and Allied Manufacturers' Association has ambitious proposals for the letting of £100,000 worth of space, but it is doubtful whether contractors will find it worth while to occupy corners in that vast and heavy display of technical products. Had the B.E.A.M.A. schemed for some popular display which would boost the demand for electricity, contractors might have co-operated; but the authorities at Kern House appear to be confining their attention to the letting of space for "serious" exhibits and to the organisation of the First World Power Conference. The object of this Conference is 'to consider how the industrial and scientific sources of power may be adjusted nationally and industrially.' Delegates from all parts of the Empire will attend to talk about power resources, power production, research, technical education, and so on. It is magnificent, but is it business? There may be some deep commercial purpose behind this orgy of technical talk, but we fail to discern it. With all respect to our friends the manufacturers, could they not use their energies in some more direct way of stimulating the growth of British electrical industry?"

Austrian Imports and Exports.—Detailed statistics have been issued respecting the foreign trade of Austria in electrical manufactures in the first half of 1921. The figures are as follows, those for the corresponding period of 1920 being given for the purpose of comparison:—

	First half of 1920. Metric tons.	First half of 1921. Metric tons.
Imports—		
Dynamos and electric motors (except automobile motors)	247	459
Meters, &c.	20	66
Switches, contacts, &c.	86	131
Electric bulbs, &c.	66	173
Other electrical apparatus	143	177
Cables and insulated wires	23	29
Carbons for electrotechnical purposes	45	28
Other classes not specified	2	3
Total	634	1,070
Exports—		
Dynamos, electric motors (except automobile motors), and transformers	868	2,283
Telephones and microphones	24	189
Meters	30	93
Switches and contacts, &c.	68	144
Electric bulbs, &c.	352	674
Other electrical apparatus	385	1,053
Cables and insulated wires	230	541
Accumulators, with lead plates, and plates alone	293	366
Carbons for electrotechnical purposes	64	83
Total	2,317	5,430

The imports of electrical machinery and apparatus in the nine months ended with September, 1921, of which details are lacking, amounted to 1,545 metric tons, most of which was supplied by Germany and Czecho-Slovakia. On the other hand, the exports reached 7,996 metric tons, and were chiefly forwarded to Cezcho-Slovakia, Poland, and Jugo-Slavia.

The Scandinavian Market for Electrical Goods.—Mr. Norman D. Johnston, Canadian Trade Commissioner at Rotterdam, recently sent to the Department of Trade and Commerce at Ottawa a report on the market for electrical apparatus in Scandinavia. After briefly reviewing the situation in Denmark, Sweden, and Norway, he makes the following general observations:—

In general, it may be said that among those products in demand in Scandinavia are electrical motor accessories, household electrical articles such as irons, toasters, &c.; heating apparatus, electrical machinery of various kinds; material for the Government railways and power plants; equipment for the municipal light, heat and power plants; as well as all kinds of electric fittings and cables. Heating apparatus is coming largely from the United States and Switzerland, while Germany supplies most of the imported light fittings. In most of the electrical products it is very difficult to compete with the low German prices which are quoted on account of the low exchange value of the mark. A similar factor also applies in the case of those products manufactured in Norway and Sweden, where the currency is depreciated. It may, therefore, be said that until conditions become more normal, a large proportion of the trade which is not done by Scandinavian firms themselves will go to Germany. At the present time business in electrical products is not very good on account of the slump in trade, but it is very likely that there will be a large trade done in the future as there are uncompleted power, heating, and lighting schemes which will mean a demand for transformers, motors, and all kinds of machinery and cables, as well as lighting, cooking, and heating apparatus. Electricity is being used extensively, and the trade in all electrical products is likely to increase with the probable still greater use of electrical energy for domestic and production purposes.

Electrical Contractors' Associations.—At the annual meeting of the E.C.A. (Inc.), the N.E.C.T.A. and the N.F.E.A. held on June 21st, it was stated that the membership of these three associations continued to make progress, and was, at May 1st, as under:—

E.C.A.: Full members, 672; second members, 71. Total, 743.

N.E.C.T.A.: Full members, 532; second members, 61. Total, 593.

N.F.E.A.: Full members, 667; second members, 76. Total, 743.

Osram Delivery Service.—The General Electric Co., Ltd., has recently installed a fleet of motor lorries at its Osram G.E.C. Lamp Works, Brook Green, Hammersmith, in order to render its delivery as efficient and up to date as possible. These vehicles, which were built by the Associated Equipment Co., are used for collecting raw materials from the docks, and crates of lamp bulbs made at the Lemington Glass Works from the railway terminus; but their main employment is in delivering consignments of Osram lamps

direct from the works to customers' premises in the London area and to railway stations and docks in the case of country and export orders. Large stocks of all standard lamps are held at Hammersmith, and, with the new lorry service, the prompt delivery of orders will be assured.

Copper and Lead Prices.—Messrs. James & Shakespeare report, July 19th: Copper bars (best selected), sheet and rod, no change; English pig lead, £26 15s. (£1 decrease).

The Austrian Electrical Industry.—The report of the Austrian Siemens-Schuckert Co. of Vienna states that, notwithstanding the economic crisis, it was possible to provide adequate occupation for the works and also obtain orders through the cultivation of new connections. Thus, for instance, the company participated in the formation of a Jugo-Slav company which has branches in Belgrade, Zagreb, Laibach, and Serajevo, and has already received noteworthy orders. In addition, the electrification of some lines of the Austrian State railways was asserting itself. As to the present year, the report states that the early months were quiet, but the sudden fall in the German mark rendered it difficult to compete. The costs of production in Austria, owing to the general inland costliness, have in part considerably exceeded the German sale prices, but there are no signs of a crisis in production or sales. It is hoped to receive orders from the State and others in connection with the erection of public hydro-electric works, although these will be unable fully to occupy the works. In every case a serious price contest with German competitors is impending, as the sale prices of the latter only slowly follow the depreciation of the mark. The net profits are returned at 40,800,000 crowns for 1921, permitting of the payment of a dividend at the rate of 20 per cent.

Poland as a Field for Enterprise.—A memorial has been published by the Union of Polish Electrical Works stating that the electrification of the country will be impossible under existing conditions without having recourse to the co-operation of foreign capital. Apart from Upper Silesia, the number of supply works in Poland proper is 350, but only about fourteen can be considered as large works, as, for instance, those at Warsaw, Lodz, Sosnovice, and Cracova. Most of the works are in the hands of private companies working under municipal concessions. The average annual consumption per head of the population is stated to be merely 10 kWh, as compared with 170 in Germany, 240 in Switzerland, and 380 kWh in the United States. As the existing electrical manufacturing works have not reached a high stage of development, most of the machinery and plant has to be procured from other countries, which is now a very difficult matter owing to the very low level of Polish exchange.

The country possesses adequate resources for the production of electrical energy. These include pit coal in the districts of Dombrowa, Cracova and Upper Silesia; water power in the Carpathians capable of yielding 3,000,000,000 kWh per annum; petroleum, natural gas, lignite, and peat. It is calculated that a capital of 39,000,000 dollars would be required to defray the cost of the construction of works adequate to meet present requirements, including tramways, the absence of which is keenly felt in many towns; and 60 per cent. of the expenditure would apply to machinery and accessories. In conclusion, the Union complains that the Government has not yet taken any steps to make known in the West the great sphere of activity which Poland offers to private initiative.

Annual Outings.—Messrs. Robson & Coleman, of Newcastle-upon-Tyne, held their annual excursion on Saturday, July 8th, the staff and employés and friends, to the number of 75, proceeding by train to Corbridge, where lunch and tea were served at the Angel Hotel. The weather was not favourable, but the premises of the local rowing club were available. Vocal and instrumental selections were given by Messrs. Mitchell, Turpin, Chambers, and Aitchison. Between the showers, sports were indulged in, comprising skipping and potato races for the ladies and tug-of-war and quoits for the men. After tea Mrs. Robson presented the prizes.

The staff of the South Wales Electrical Power Distribution Co.'s station at Upper Boat, Treforest, held its annual outing on Saturday last to Weston-super-Mare. Mr. W. A. Chamen, managing director of the company, and Mrs. Chamen accompanied the party. Mr. Chamen presided at the luncheon, and several of the staff testified to the mutual good feeling maintained by the company and its staff.

E.D.A. Activities.—The Association, in continuation of its electric fan "campaign"—which the weather is not at present aiding—has published a short history of the fan from the earliest days of mankind (E.D.A. 284), through Egypt, China, and Babylonia and mediæval times, culminating in the development of the electric fan, which does its work without inconvenience to someone else. The pamphlet is artistically produced and includes two illustrations.

The Association has also issued a poster (E.D.A. 278) bearing the heading "Use Electric Power and Your Costs Will Fall," and showing the collapse of a chimney stack—symbolising the end of waste.

Wages in the Plymouth Electricity Department.—The note on this subject in our last issue (p. 52) ended with the words "proposed amendment." The last word was used in the sense of "reform," and did not imply an amendment to the resolution previously mentioned, which, couriously enough, embodies the "amendment" in question.

German Reparations in Kind.—The following resolution passed by the Executive Committee of the F.B.I. at its meeting in London on July 12th was forwarded to the Prime Minister by Col. O. C. Armstrong, D.S.O., the president of the Federation of British Industries:—"In view of the present position respecting the questions of reparations and German exchange, the Federation of British Industries desires to reiterate the request submitted to the Prime Minister on December 19th, 1921, that H.M. Government should not commit themselves to any step for modification or revision of the existing arrangements until industry, which is more vitally affected than any other section of the community by the reactions of these problems upon the world's economic system, has been given an opportunity of expressing its views. The Federation is especially concerned that the credit of the country shall not be definitely pledged for the purpose of rendering financial assistance to Germany until such consultation shall have taken place."

We read in the F.B.I. *Bulletin* that this resolution was put to the committee on the proposal of Sir Peter Rylands.

A Six Months' Review.—The *Board of Trade Journal*, in the course of an industrial survey of the first half of 1922, refers as follows to the engineering and hardware trades:—"The long drawn out dispute in the engineering trades came to an end on June 13th, after 13 weeks' stoppage. The trade outlook is still bad for some branches, but others have substantial accumulations of orders to start on. The outlook is very poor for those sections connected with shipbuilding. The electric and motor industries are said to have good prospects, while the textile machinery trades are booked up with orders for months ahead. The extensions of the London Electric Railway, the decision of several other railway companies to make substantial additions to their locomotives and rolling stock, and the Indian Railway programme, should materially benefit important sections of the industry. It is not, however, expected that the revival of trade will be rapid or that unemployment for some time to come will be other than severe. There will probably have to be some further reduction of costs before confidence in present values is assured. In this connection it is to be noted that engineering employers are now pressing for a reduction of the bonus of 26s. 6d. per week. Until this question is settled there is bound to be some hesitation in placing orders. Hardware manufacturers have been passing through an unhappy time but, with the liquidation of stocks, the outlook is said to be improving. While the machine-tool trade has suffered from the disposal of Government stocks, the demand for small and hand tools has improved. Rustless iron and steel products and stain-resisting nickel goods are in good demand. The cutlery trades on the whole are slack, and the pen and pocket-knife branches continue to find German competition difficult to meet."

Our Foreign Trade.—JUNE FIGURES.—The following were the values of imports and exports of electrical goods and machinery during June, 1922:—

	June, 1922.	Inc. or dec.	Inc. or dec. 6 months, 1922.
Imports—	£	£	£
Electrical goods and apparatus ...	89,784	−101,675	−623,630
Machinery ...	664,747	−118,617	−2,980,840
Exports—			
Electrical goods and apparatus ...	519,911	−357,279	−3,964,120
Machinery ...	2,321,902	−2,963,228	−15,146,710
Re-exports—			
Electrical goods and apparatus ...	7,731	−6,354	−38,668
Machinery ...	75,400	−26,692	−101,118

The Engineering War Bonus.—As the result of further discussion on Tuesday between the Engineering Employers' Federation and the Unions, the representatives of the latter decided to submit the proposals for bonus reductions in three instalments of 5s. 6d. each to a ballot of their members, to be returnable by July 28th.

Lamp Contracts.—THE ENGLISH ELECTRIC & SIEMENS SUPPLIES, LTD., has received a contract for the supply of Siemens Britannia metal-filament lamps for six months to the Booth Steamship Co. The Great Northern Railway Co. has accepted a tender for the supply of Siemens Britannia lamps for train lighting.

The Woman's Exhibition.—The exhibition organised by the *Daily Express* opened at Olympia on July 12th and will continue until the 29th. Several electrical firms have exhibits, and we propose to give some details of these in our next issue.

British Industries Fair (Birmingham).—We have received from the General Manager of the Birmingham section of the British Industries Fair an advance prospectus of the arrangements for the next display which will be held from February 19th to March 2nd, 1923. This indicates that the exhibition will follow closely the lines of this year's show, there being eleven groups: Brassfoundry, hardware, and ironmongery; metals; construction, building, and decoration; power, lighting, heating, cooking, and ventilating; engineering; agriculture; mining; motors, motor-cycles, &c.; guns, saddlery, harness, &c.; brewing, distilling, and catering; and "services" (*i.e.*, journals, trade organisations, &c.). The registered office is at the Chamber of Commerce, 95, New Street, Birmingham.

Falco-Hotpoint Co-operation.—The annual meeting of the Falkirk Iron Co. was held last week, when a dividend of 10 per cent., less income tax, was approved. The chairman (Mr. R. W. Kennard), in his speech, stated that the accounts showed satisfactory trading with a reasonable profit and a strengthening of their already sound financial position. In alluding to the electric heating and cooking side of the business, the speaker said the situation in this country was such that before manufacturers could expect a demand that would make it worth while developing manufacture along the lines upon which it should be developed, a great deal of expensive propaganda must be undertaken to bring home to the public the advantages arising from the domestic applications of electricity. The company had just concluded arrangements with the Hotpoint Electric Appliance Co., London, under which the Falkirk Co. would be free to concentrate their energies on the manufacturing side, leading the Hotpoint Co. to apply its selling organisation and propaganda to the distribution of both "Falco" and "Hotpoint" specialities. This combination of effort (to which brief reference was made in our last issue) would be of much benefit to both the trade and the public; the Falkirk manufacturing facilities and development work, together with the Hotpoint experience and power to sell, would enable them to put the British-made article on the market at lower prices than the smaller outputs in the past would permit; this should result in increased sales, and there was no question that many of the largest distributors, appreciating the necessity for domestic electric apparatus being absolutely reliable, had refrained from adopting apparatus whose only claim was that of low price. Exhaustive experiments had been carried out by their electrical department, and they hoped shortly to place on the market a cooker which would revolutionise present methods of cooking by electricity, both for domestic and restaurant work.

The A.E.U.—The membership of the Amalgamated Engineering Union has dropped from 440,000 to 394,000 during the last 12 months, and there has been a shrinkage of between 7,000 and 8,000 members alone during the past month.—*Birmingham Post.*

The Trade Position.—In a speech recently delivered at Newcastle, Mr. Stanley Baldwin, President of the Board of Trade, said that the position of Europe to-day was very grave, and the position of Germany was very grave. With regard to our own position he was more hopeful to-day than he had been the last three years, and for this reason—that he believed that all classes of the community realised as never before the need for peace and for common working together. They had also to-day a slow but steady and real improvement in the trade of the country. That did not mean that many industries were not suffering badly, but, taking the country as a whole, things were better and were slowly getting better, but we had yet a long lane before us, and it would require all our courage, doggedness and perseverance to carry us through to the prosperity we hoped to attain.

Engineering Trade in Australia: A Serious Situation.—*The Industrial Australian*, in a recent issue, refers to the serious position of engineering trade in New South Wales as follows:—"Many of the engineering firms throughout New South Wales during the past few months have been compelled to close down their works owing to the slackness of trade. In consequence, there is considerable unemployment in the industry. A conference was held recently between representatives of the Metal Trades Employers' Association and the Amalgamated Society of Engineers, for the purpose of discussing the position, and, if possible, arriving at some scheme that would materially reduce the number of unemployed, and which would also enable the employers to carry on their businesses. The conference sat until a late hour, and at the conclusion of the proceedings it was stated that an agreement had been reached between the parties. The employers contend that there is an urgent need for a simplification of the industrial arbitration procedure. At the conference the union's representative put forward a proposal to the effect that an increased tariff on imported goods would enable local industry to be carried on, provided that the employers would be satisfied with reduced profits. However, the union delegates were opposed to any scheme that would mean a reduction in wages or an increase in hours."

Annual Sports.—The Sports and Athletic Club of Messrs. J. H. Tucker & Co., Ltd., of King's Road, Tyseley, Birmingham, announces that the annual sports meeting will be held on Saturday, July 29th. In addition to the usual contests for the cups presented by the directors, there will be a number of open events, and a cordial invitation is extended to all friends who can find it possible to attend. The meeting will be held in the sports ground at the rear of the factory in King's Road.

Model Electric Bakery.—It was reported at a meeting of the Swansea Master Bakers' Exhibition on July 11th that certain of the members had been acting in an advisory capacity to Mr. J. W. Burr, the borough electrical engineer, in the setting up of a complete model electric bakery at the electrical exhibition at Swansea in October next. It was the intention to put down a complete electrical plant, and offers had already been received from manufacturing firms for its supply.

Holidays.—The works of the London Electric Firm, Brighton Road, Croydon, will be closed from August 4th to 14th for the annual holidays. A small staff will be present to attend to urgent business.

For Sale.—By direction of the Disposal Board, Messrs. Bradshaw, Brown & Co. will sell by auction at Woolwich Dockyard, on August 15 and following days, wireless material and electrical equipment. 100-200 electric lamp standards are being disposed of by the Corporation of Edinburgh. (See our advertisement pages to-day.)

Book Notices.—The *Journal* of the Junior Institution of Engineers, Vol. xxxii, Part 10, July, 1922. London: Percival Marshall and Co. Price 2s. net.—The Gustav Canet lecture on "The Railway Act, 1921," by Sir Eric Geddes, G.C.B., &c., is reproduced in this issue; and "Notes on Hardness Testing," by R. K. Innes, also appear. Other proceedings recorded are "lecturettes" on "Engineering Business in China" and "Gold Casting under Steam Pressure," as well as visits to works, &c, and reviews of recent publications.

"M. & C. Machine Mining," July. Glasgow: Messrs. Mavor & Coulson, Ltd. Price 6d.—This issue contains several articles of value to those who have to deal with mechanical and electrical coal-cutting machines. Arrangements have been made for the binding of the first volume which this number completes.

"National Physical Laboratory: Collected Researches." Vol. XVI, 1921. Pp. 359; diagrams and illustrations 318. London: H.M. Stationery Office. Price £1 net.—An excellently-produced collection of 21 papers describing research work carried out at the N.P.L. All the papers are reprinted from the journals of various scientific societies, and most of them are descriptive of work carried out in connection with metals and alloys. Three of them, however, deal with experimental work on ships and in connection with submarine warfare, while four of the papers are of an electrical nature. The last are entitled "The Study of Thermal Electromotive Force as an Aid to the Investigation of the Constitution of Alloy Systems, with an Appendix on the Peltier and Other 'Effects'"; "A High Temperature Electric Resistance Furnace"; "The Measurement of Electrical Conductivity in Metals and Alloys at High Temperature"; and "Time-Lag in Spark Discharge" respectively.

Technical publication (Ref. A/s1) of the British Electrical and Allied Industries Research Association, being "Directions for the Study of Electrical Insulating Papers (Untreated) for Purposes other than the Manufacture of Cables." Pp. 12; 11 illustrations. London: B. E. A. I. R. A. Price 7s. 6d.—Technical publication (Ref. B/s1), being "Directions for the Study of Hard Composite Dielectrics (Insulating Materials)." Pp. 11; 19 figs. Price 6s.—The contents of both the above publications are clearly indicated by their respective titles.

"Tests on Ranges and Cooking Appliances." By A. H. Barker, Wh. Sc., &c. (Fuel Research Board, Special Report No. 4). Pp. 55+17 figs. London: H.M. Stationery Office. Price 2s. 6d. net.—This report gives copious details of tests upon coal fires and ranges, together with comparisons with gas appliances. Electric cooking is not touched upon, but the results obtained may be useful to manufacturers of electrical cooking appliances as standards of comparison.

"Wireless for Australia."—Amalgamated Wireless (Australasia), Ltd., has issued a well-produced illustrated booklet in which an account is given of the extraordinary general meeting that was held at Sydney, N.S.W., on April 24th last, for the purpose of putting into operation the agreement which has been arrived at recently with the Commonwealth Government for the establishment of direct wireless communication between Australia and England. A general outline of the steps leading up to the agreement, a brief statement of what it consists of, and the company's immediate programme, are also included amongst other information.

"Engineering Abstracts from Current Periodical Literature." New series, No. 12. July, 1922. (228 pp.). London: The Institution of Civil Engineers.

LIGHTING AND POWER NOTES.

Aberdare.—EXTENSION OF SUPPLY.—The Urban District Council has under consideration a scheme for extending the supply of electricity to Cwmdore, Hirwain, and Llydcoed. A detailed estimate of the cost of the undertaking is to be considered by a special committee.

Accrington.—YEAR'S WORKING.—The accounts of the municipal electricity undertaking for the year ended March 31st, 1922, show a total revenue of £80,225, as compared with £76,776 in the previous year. Working expenses amounted to £45,548, as against £71,967, leaving a gross profit of £34,677 (£4,809). After payment of capital charges the net result was a profit of £13,790, comparing very favourably with a net deficit of £9,109 in 1920-21. The capital expenditure during the year was £29,397, the bulk of which (£26,872) was spent on account of a new turbine, boilers, condensing plant, converters, transformers, switchgear, &c. The total number of units sold fell from 8,962,083 to 7,946,852. The capacity of the station was increased from 6,000 to 7,000 kW.

Barnstaple.—Proposed Purchase of Undertaking.—The Lighting Committee has considered the offer of a syndicate to purchase the municipal electricity works, and it was agreed to open negotiations.

Burton-on-Trent.—Extension of Supply.—The Electricity Commissioners have sanctioned the Council's application to supply electricity to Bretby Colliery and to the Heathcote Pottery Co., Ltd., outside the area of supply of the Electric Lighting Order, 1890.

Ceylon.—Hydro-Electric Scheme.—According to *Indian Engineering*, a hydro-electric scheme is to be commenced in September this year. The centre of distribution is within 42 miles of Colombo and 150 miles from the furthest point in the island. The scheme will be divided into four stages. In the first stage, a basin will be constructed which will provide nearly 30,000 h.p. and will cost about Rs.15 millions. The second part will increase the power available to 10,000 h.p., and a fresh source will be tapped in the third stage, giving an additional 50,000 h.p. In the last stage an artificial lake will be constructed which will bring the output to 250,000 h.p. The estimated total cost of the scheme is Rs.70 millions.

Chesterfield.—Price Reduction.—The Town Council has reduced the price of electricity for lighting from 85 per cent. to 60 per cent. above pre-war charges, and for power and heating from 100 per cent. to 75 per cent.

Continental.—Esthonia.—A scheme is being promoted for the utilisation of the fall of the Narova river, which is expected to yield 70,000 h.p. According to a plan prepared by the Narwa Hüdro-Elektrijaama Projekteerimiscrüroo, it is proposed gradually to install six Francis turbines, each of 12,000 h.p., which will operate 6,000-V a.c. generators. It is intended to transmit about 55,000,000 kWh per annum to Reval at 110,000 V, the distance being 136 miles. The estimated outlay on the works will amount to 1,000,000,000 Esthonian marks, with an addition of 330,000,000 marks for the transmission line. The scheme is to be undertaken gradually, and a sum of 800,000,000 marks is required for the first instalment.

Darlington.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £31,731 to cover expenditure on plant, mains, &c.

Renfrewshire.—Extension of Supply.—The Strathclyde Electricity Supply Co. proposes to apply to the Electricity Commissioners for a Special Order authorising the company to supply electricity in parts of the parishes of Paisey, Eastwood, and Neilston.

Rochdale.—Interruption of Supply.—A complete interruption of not only the local, but also the general South-east Lancashire supply of electricity was caused by a rat at Passmonds, Rochdale, about 10 p.m. on July 11th. At that time a heavy short circuit occurred in one of the feeders of the supply station at Messrs. S. A. Heywood & Sons' works, Passmonds, which are supplied with power at 6,000 volts. On investigation it was found that a rat had gained access to an e.h.p. switch, causing a short circuit across the terminals. This resulted in the destruction of the switch and the consequent interruption of the supply. As under existing arrangements the Rochdale undertaking is linked up with the Lancashire Electric Power Co.'s supply system at Outwood, Radcliffe, the effect of the disturbance was felt immediately both there and in many of the South-east Lancashire towns, even, in fact, as far as Wigan. The supply was quickly restored.

Special Electricity Orders.—Confirmations.—The Minister of Transport has confirmed the following Special Orders made by the Electricity Commissioners:—Kilmarnock (extension); Kirkintilloch and district; Preston; Renfrew and district; Alderley and Wilmslow; Isle of Wight; Atherstone and district; Cookham; St. Mellons and district.

Surbiton.—Plant Extensions.—Messrs. Callenders are about to make extensions to their central generating station, and propose to take a bulk supply of electricity, which will involve a change from direct to alternating current. New plant is to be installed at an approximate cost of £20,000.

Thrapston.—Electricity Supply.—The Urban Council has referred to a committee the question of establishing electricity works for the town.

Urban Electric Supply Co., Ltd.—Special Order.—The Electricity Commissioners have granted a Special Order to the company, which so amends a number of local Orders as to provide that the company, the local authority concerned, or not less than twenty consumers, may, every three years from the date of the Special Order, ask for an inquiry by the Minister of Transport with a view to the alteration of the prices charged.

Wakefield.—Price Reduction.—The Electricity Committee has recommended that the charge for electricity to ordinary power consumers be reduced by taking 20 per cent. off the war increase.

Extension of Supply.—The Council has decided to extend its electricity supply to Alverthorpe, and Sandal, and application is to be made to the Electricity Commissioners for sanction to the borrowing of £5,000 for mains.

Weymouth.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £1,000 for mains extensions.

Whitehaven.—Loans.—The Town Council has applied for loans of £1,000 for mains and services, and £960 for public lighting.

Wolverhampton.—Price Reduction.—The Town Council has reduced the charge for electricity for lighting, power, and general supplies, other than flat-rate lighting supplies, from 115 per cent. to 90 per cent. above pre-war charges.

TRAMWAY AND RAILWAY NOTES.

Continental.—Spain.—A new electric railway has recently been completed and put in operation between La Coruna and Sada, a distance of about 12½ miles.

Croydon.—Year's Working.—The report upon the tramway undertaking (manager: Mr. T. B. Goodyer) for the year ended March 31st last records a total revenue of £181,737, as compared with £178,772 in the previous year. Working expenses totalled £163,715, as against £183,387, leaving a credit balance of £18,022; in 1920-21 there was a gross deficit of £4,615. Capital charges absorbed £14,767, and the net result was a profit of £3,255, carried to reserve. The sum of £2,891 was spent from reserve on a new feeder cable, leaving a balance of £364. The net deficit in the previous year was £19,611. There was a decrease of 11 per cent. in the number of car-miles run, the figure being 2,340,093, and the passengers carried (24,976,440) decreased by 7 per cent. A table of comparisons given in the report shows that the gross expenditure per car-mile was 16.79d. in 1921-22, as against 7.404d. in 1913-14. The revenue per car-mile has increased in a greater ratio, the figures being 7.52d. in 1913-14 and 18.63d. in 1921-22. The number of car-miles run in the past year was considerably below the pre-war figure.

Heywood.—Year's Working.—The annual report on the working of the tramway undertaking (manager: Mr. H. C. Day) for the past year shows a total income of £23,457, as compared with £25,901 in the previous year. Working expenses amounted to £21,959 (£22,125), leaving a gross profit of £1,497 (£3,775). After deduction of capital charges there was a net loss of £2,431. In the previous year there was a loss of £311.

London.—Moor Lane Fire Inquiry.—The inquiry concerning the recent fire at the electric sub-station of the Metropolitan Railway Co., at Moor Lane, City, was concluded before Dr. Waldo, the City Coroner, on July 18th, when the jury returned a verdict that the fire was caused by an electrical fault in a transformer. They added a rider that the spread of the fire was due to the absence of sand or other fire extinguisher, and that the fire brigade should have been summoned very much earlier than was done. In summing up, the Coroner said that 45 minutes of valuable time had been wasted before the fire brigade was called. When a police constable first suggested that the brigade should be called an official told him "it was more than he dare do."—*Morning Post*.

Northampton.—Year's Working.—The results of working of the Corporation tramways for the year ended March 31st last were as follows, the previous year's equivalents being given in parenthesis:—Total revenue, £72,519 (£75,058); working expenses, £56,342 (£71,155); gross profit, £16,177 (£3,903); net result, £5,792 profit (£5,232 deficit). Car-miles run, 749,268 (797,207); number of passengers carried, 10,534,713 (11,375,160).

Pontypridd.—Sunday Services.—The Rhondda Tramways Co. has come to an agreement with the Council, whereby the company will run its cars over the Council's track between Trehavod and Pontypridd on Sundays. £500 per annum is to be paid to the Council for the use of the track.

Sunderland.—Year's Working.—The report of the general manager of the Corporation tramways (Mr. A. R. Dayson) records a total revenue of £138,821, as compared with £158,165 in the previous year. Working expenses decreased to about the same extent, from £136,668 to £118,156, leaving a gross balance of £20,665 (£21,497). The balance of net revenue carried to appropriation account was £8,757 (£8,017). This extinguished the 1920-21 deficit brought forward, and the balance was used for loan repayment and renewals fund. The number of car-miles run decreased from 1,647,618 to 1,481,755.

Wolverhampton.—Year's Working.—The annual report of the general manager and engineer of the municipal tramway department (Mr. C. Owen Silvers) for the year ended March 31st last shows a total income from all sources of £121,096, comparing with £126,294 in the previous year. The working expenditure was £94,417, as against £107,458, leaving a gross balance of £26,679 (£18,836). Decreases were shown in the cost of power, wages, and maintenance costs. Interest and other capital charges absorbed £21,685, and there was a credit of £1,124, giving a net result of £6,118 profit, as against £2,934 in 1920-21. The motor-omnibus accounts recorded a net profit of £1,481. The number of passengers carried on the tramways showed a considerable reduction—from 19,370,676 to 15,691,440, although the car-mileage remained at about the same level.

TELEGRAPH AND TELEPHONE NOTES.

Austria.—WIRELESS TELEGRAPHY.—The Chief Committee of the Austrian National Council, on July 13th, approved the decision of the Cabinet to grant to Marconi's Wireless Telegraph Co., of London, a concession for a wireless service between Austria and foreign countries. An Austrian joint stock company must be formed within six months by the Marconi Co., whereupon the concession will be automatically transferred to the former company, says the *Morning Post*.

The Austrian Government, says the *Financial Times*, will participate to the extent of 30 per cent. of the capital, and a group of Austrian banks will co-operate with the Marconi Co. in founding the Austrian Co. This concession was obtained against very strong competition on the part of the Berlin Telefunken Co.

The London Marconi Co. will subscribe more than half the capital, says the *Daily Mail*, and will erect two transmitting stations and three receiving stations near Vienna and one control station in the centre of Vienna, and hand them over ready for use to the Austrian Marconi Co. The concession confers the exclusive right of conducting public wireless services between Austria and all other countries for a minimum period of thirty years.

The Marconi Co. will take over the Austrian Government's existing wireless stations at Deutschaltenburg and Laaerberg, and will modernise them so that they will be capable of handling 150 words per minute. The rates for messages will be the same as those charged for telegrams by wire.—*Reuter*.

Australia.—WIRELESS TELEGRAPHY.—The Federal Government's life hung in the balance for a few minutes in the House of Representatives on July 14th. The agreement with the Amalgamated Wireless Co. to provide direct wireless communication with Great Britain was challenged by the Labour Party over the appointment of Sir Thomas Hughes, formerly Lord Mayor of Sydney, to the Joint Board. The company and the Government have each three directors. They were unable to agree on the seventh, and the arbitrator, under the agreement, selected Sir Thomas Hughes, chairman of the Amalgamated Wireless Co., thus giving the company a majority on the directorate, though the Government holds the controlling interest. The Labour Party forced the Government to decline to accept the appointment, and then asked for the adjournment of the debate. Mr. Greene, who is in charge of the House in the absence of the Prime Minister through illness, saw that resistance was perilous, and gave way.—*The Times*.

Senator Pearce outlined in the Senate, on July 11th, the Government's new proposals for assisting the development of the Northern Territory of Australia. The Commonwealth Government is convinced that the Territory must be treated as pastoral, but that the isolation must be broken down by the establishment of prompt and effective communication. Negotiations have been opened with the Australian Amalgamated Wireless Co. to install wireless telephones with a central station capable of communicating with the different holdings. —*The Times*.

GOVERNMENT MANUFACTURE OF TELEPHONES.—The Commonwealth Government proposes to utilise a section of its Lithgow small arms factory for the manufacture of telephones.—*Reuter's Trade Service*.

Germany.—TELEPHONE EXTENSIONS.—The Inter-Allied Commission has had to make strong representations to the German Government against a scheme which it found was being undertaken for the transformation of the German trunk telephone system from overhead to underground lines. The Germans pleaded that this was a necessary outlay, because it would so much improve the efficiency of the service. To this the Inter-Allied Guarantee Commission has replied that until Germany has paid her foreign debts such a lavish outlay on her part would be totally unjustified, says the *Daily Mail*.

The French Press draws attention to the vast public works now being carried out, or about to be carried out, in Germany. In the German Budget for 1921-22 no fewer than 2,320,000,000 marks are provided for new construction, says the *Evening News*, of which 1,416,000,000 marks are for the extension of the telephone system, with an additional 600,000,000 for underground cables.

Holland.—NEW TELEPHONE CABLE.—The long-awaited telephone cable between Britain and the Netherlands has been laid. It was landed by a British cable ship near Dornburg, on the Dutch coast, on July 8th, after considerable difficulty, owing to bad weather. The cable is 100 miles long, and was laid by the Eastern Telegraph Co.

Japan.—WIRELESS TELEGRAPHY.—Representatives of some ten leading shipping and business houses are planning the promotion of a wireless company with a capital of 200,000,000 yen for the improvement of transpacific communication. The preliminaries are now being negotiated with the Government. —*Reuter's Trade Service* (Tokio).

It is learned in New York financial circles that the company is to be an American-Japanese one, says the *Financial Times*.

South Africa.—WIRELESS BROADCASTING.—The Union Government has approved of the Post Office receiving applications for the establishment of broadcasting wireless telephone services. The circulation of advertising matter and commercial traffic is, however, not to be permitted, says *The Times*.

WIRELESS TELEGRAPHY.—The Marconi Co. has submitted a scheme providing for the formation of a South African wireless company, with a capital of £500,000, four-fifths to be subscribed in London and the remainder in South Africa. The company undertakes to construct and work a station out of range of gunfire from the sea, capable of communicating direct with England, India, China, Australia, the United States, and South America.—*The Times*.

According to the *Morning Post* it is proposed that the Government shall have the right to purchase the new undertaking after 10 years, and that in the case of an emergency, the Government will take control of the new station. The proposed rates are to be 6d. per word for a full-rate message; 8d. per word for deferred and Government traffic, and the Press rate to be 2½d. per word. The Marconi Co. is to arrange for a suitable corresponding station in the United Kingdom, to place at the disposal of the S.A. Co. all patents, &c., and to guarantee a 10 per cent. improvement in the daily service over the Australian guarantee, which is for an uninterrupted service for 300 days yearly, with a minimum of 12 hours per day. It is reported that the South African Government's technical adviser has reported favourably on the scheme, which is independent of the proposed Imperial P.O. chain of stations.

Mr. C. F. Elwell, of London, who arrived at Capetown on July 18th, is submitting to the Union Government a scheme which the *Morning Post* describes as an alternative to Marconi's offer. He states that his firm is willing to furnish, erect, and hand over in complete working order, within twelve months from the date of receipt of the order to proceed, a high-power station, including 820-ft. masts and Poulsen arc generators sufficiently powerful to guarantee a service of twenty-five words per minute for not less than twelve hours a day, and for not less than 350 days in the year, for a sum not exceeding £150,000. A more powerful station could, if necessary, be built, comprising twice as many towers and more powerful arc generators, for a sum not exceeding £200,000.

The Telegraph Service.—UNDERGROUND CABLES IN SCOTLAND. —On July 17th, in the House of Commons, the Postmaster-General was asked whether, in view of the delays to business occasioned in Scotland, north of Edinburgh and Glasgow, by breakdown through storm in the overhead telegraph trunk system, he would now proceed to have the system put underground with the view of remedying this defect at an early date, and at the same time providing work for the unemployed.

Mr. Pike Pease (Assistant Postmaster-General) said that the provision of underground cables between Edinburgh or Glasgow and the North of Scotland would involve heavy expenditure, and could not be undertaken at present. He fully appreciated, however, the importance of electrical communication to the fishing and other industries in the north of Scotland, and he had under consideration the questions of specially strengthening one of the overhead routes, and of providing a wireless service between Stonehaven and a station in the south for use in emergency.

Wireless Telegraphy.—IMPERIAL CHAIN.—In the House of Commons, on July 13th, in reply to a question, the Postmaster-General said the Government had further considered the question of the Imperial Wireless Chain, and had decided to erect in England a station of the ultimate power (240 kW) contemplated by the Expert Commission, instead of the smaller power (120 kW) which it proposed should be used in the first instance. This station would provide especially direct commercial communication with India, South Africa, and Australia. In India the Imperial Government would erect and the Indian Government would work a station also capable of direct communication with England, South Africa and Australia. As a corollary of this decision the proposed second station in Egypt and the station in East Africa would be deferred, and the erecting of stations at Singapore and Hong Kong would be reconsidered. Experts of the Canadian Government were expected to reach England very shortly in order to discuss the participation of Canada in the scheme, says *The Times*.

Communication is proceeding with the Union Government as to the station in South Africa, and the *Daily Express* points out that the decision to make the "steps" of the chain 4,000 instead of 2,000 miles, as originally suggested, represents the end of a prolonged controversy regarding the ownership of means of Imperial communication between the mother country and British territory overseas, it having been decided that they shall be State-owned and State-operated. The daily Press reports that surprise is expressed in India at Mr. Kellaway's statement concerning the proposed Indian station, as it has been understood that the Imperial chain would consist of "steps" of 2,000 miles, and not 4,000, as now announced, while the Indian Government, for financial reasons, has been inclined to give the concession to private enterprise and an Indian company has undertaken to carry out the work on condition that it secures full Government control.

Developments.—When addressing the cadets at the Royal Military Academy, Woolwich, recently, Lord Cavan, Chief of the Imperial General Staff, referred to the heavy casualties among men burying telephone wires during the war, and said that the Army Council had decided that in future wars there would be no telephone wires from "division" to the front line; therefore officers should obtain a knowledge of wireless.

An interesting new type of aerial has been satisfactorily tested for the reception of long-distance wireless, which is nothing more than two pairs of wires suspended from telegraph poles by means of ordinary porcelain insulators. The aerial is eight miles in length, and is stated to give better results than one previously suspended between 320-ft. and 100-ft. towers. A similar aerial, just over a mile in length, is being used for reception at ship stations.

An advance in technique may be looked for as the result of a new type of microphone. The drum of the microphone is fitted with a coil which vibrates in sympathy with it, and being placed in a strong magnetic field, the vibrations create electrical impulses, which are carried by wireless in the usual way. The voice currents are stated to be remarkably true, and the reproduction of music highly successful.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Melbourne.—October 17th. Postmaster-General's Department. Automatic c.b. telephone equipment, with all associated equipment, including material for use at subscribers' premises. (Sched. 39 and 40.) (July 7th.)

September 27th. Telephone apparatus and parts. (Sched. 561.) (July 14th.)

Brisbane.—September 20th. Postmaster-General's Department. Supply and delivery of switchboard apparatus and parts. (Sched. No. 559.)*

Belgium.—July 27th. Municipal authorities of Schaerbeek, Brussels. 550 electricity meters for single-phase l.p. mains and 10 meters for h.p.

Suarlée (Province of Namur).—The municipal authorities are inviting tenders until July 29th for the establishment of a system of electricity distribution in the town.

Bishop's Castle.—August 5th. Installation of electric lighting in the Parish Church. (See this issue).

Brigham, Cockermouth.—July 25th. Electric light installation at the parish church. The Vicar.

Dublin.—July 25th. Electric and Public Lighting Committee. (a) Supply to Pigeon House Works of one Edwards air pump, with accessories and pipework; (b) supply and installation of one 210 h.p. 3-phase motor; (c) rewinding the stator of existing 210-h.p. 3-phase motor. Particulars and forms of tender from City Electrical Engineer, Fleet Street, Dublin.

August 1st. Corporation. Two sets electrically-driven sewage pumps for the Ringsend pumping station. Chief engineer, Castle Street.

France.—Paris.—August 2nd. Two electrically-driven travelling bridges for the sub-station of St. Germain-en-Laye and Chatou. Service Electrique, 43, Rue de Rome, Paris.

Horsham.—July 31st. Urban District Council. 1,000 yd. of l.p. 3-core .007 sq. in. paper-insulated, lead-sheathed, steel tape-armoured cable suitable for 660 V working pressure. 1,000 or 1,500 yd. of 2 core .007 sq. in. cable as above. The Electrical Engineer, Stanley Street, Horsham. (See this issue.)

India.—July 28th. High Commissioner's Department. Telephone switchboards and desk and wall sets. (July 7th.)

Liverpool.—July 24th. West Derby Union. Electricity supplies. G. W. Coster, clerk to Guardians, Union Offices, Brougham Terrace, Liverpool.

Manchester. — August 8th. Tramways Department. Supply of permanent-way special track work. Specifications and forms of tender from Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester. (Deposit £1 1s., returnable.)

Oxford.—August 15th. Oxford Electric Co., Ltd. One 1,000-kW turbo-alternator and condensing plant; and one 500-kW conversion plant (3,000 V, 3-phase, to 1,100 V, d.c.), complete with switchgear. (See this issue.)

Plymouth.—August 4th. Electricity Department. Transporter runway travelling trolley hoist. (July 14th.)

South Africa.—Grahamstown.—September 1st. Electric lighting plant and equipment, comprising steel poles, overhead wiring, house services, fuses, transformer switches, meters, street lamps, &c. Consulting engineer: Prof. W. Buchanan, 75, Louis Botha Avenue, Houghton Estate, Johannesburg.*

Tasmania.—Hobart.—October 2nd. City Council. Tenders for 750-kW rotary converter and transformer and 550 volt, d.c. switchboard panel. Tenders are returnable at Hobart on October 2nd next, and particulars, which have been posted, are due to arrive at the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2, about the middle of August.

Warrington.—July 24th. Electricity and Tramways Committee. (a) Cast-iron circulating pipes; (b) steam pipes, feed tank, &c. Mr. F. V. L. Mathias, borough electrical and tramway engineer, Howley, Warrington.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Barnes.—Urban District Council. Accepted:—
Feeder cable (£3,490).—Siemens Bros. & Co., Ltd

China.—Peking Tramways. (Prices in gold dollars):—
Boilers (109,000).—Babcock & Wilcox.
Engines and generators ((109,000).—Brown, Boveri.
Transformers (24,000) and overhead equipment.—Siemens-Schuckert.
Rails (295,000) and cars (55,000).—A French company, through the Anglo-French Corporation.—(Abstracted from *Eastern Engineering.*)

Faversham.—Town Council.
Underground cables (£555 10s.).—Pirelli-General Cable Works, Ltd.

India.—Karachi Electric Supply Corporation, Ltd. Accepted:—
Two 500-kW Diesel-driven flywheel alternators to the specification of Messrs. Handcock & Dykes:—
Engines (crosshead type).—Mirrlees, Bickerton & Day, Ltd.
Alternators.—Electric Construction Co., Ltd.
Contract price for the two sets, f.o.b. English port, £34,950.

Salop.—Education Committee.
Installation of electric lighting at Bishop's Castle secondary schools (£77 10s.).—Smallwood & Co., Shrewsbury.

Sunderland.—Town Council. Accepted:—
Temperature recording and indicating instrument for turbine.—Cambridge Scientific Instrument Co.
Tube cleaner.—Babcock & Wilcox.
Cable.—British Insulated & Helsby Cables, Ltd., and Pirelli-General Cable Works, Ltd.

Weymouth.—Town Council.
Electric lighting on the housing estate at Westham (£188 10s).—W. Smith & Son.

FORTHCOMING EVENT.

Eastern Associated Telegraph Companies.—Monday, July 24th. At the Royal Botanic Society's Gardens, Regent's Park. Banquet, fête, and reception in celebration of the 50th anniversary of the incorporation of the companies.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week, we need the names of manufacturers or suppliers of:—

Victor switches.
Electropoise Birmingham refills.
Bracket switches resembling gas taps.

NOTES.

The Proposed Visit to Gennevilliers.—Great interest is being shown in our proposed excursion to the Gennevilliers power station, of which further particulars are given in this issue; provisional applications are flowing in at a gratifying rate, and in many cases are accompanied by interesting suggestions with regard to the programme. In addition to the charabanc tour through part of the "devastated area" proposed by Major Rich in our last issue, it has been suggested that the party should visit the new power station of the Usine Centrale d'Energie Electrique du Nord de la France at Comines, a super-power station which is nearing completion at Beuvry, and the large extension of the 80,000-kW power station at St. Ouen of the Compagnie Parisienne de Distribution d'Electricité; and one enterprising correspondent wishes to know whether arrangements can be made to fly to Paris. The visit is, certainly, in one sense, "in the air" as yet, though every day's mail strengthens the support that is being given to the scheme; it may be possible for some members of the party to adopt the aerial route, but we anticipate that the majority will prefer the more prosaic modes of transport.

The original proposal in our issue of July 7th, p. 2, was to leave London on Friday, September 22nd, with the Gennevilliers 200,000-kW power station as the main objective, and to return on Monday night, September 25th; those who could spare the time might extend the tour to include other new steam power stations, and the hydro-electric works at Grenoble. These are merely the tentative outlines of the programme; as shown above, other proposals are coming in, and

we shall be glad to receive further suggestions and comments from readers who are interested in the scheme, as well as provisional notices of intention to take part in the visit, which will, of course, in no way commit the writers to participation if for any reason they are unable to join the party.

The sooner we know how many are likely to go to Paris, the sooner we shall be able to submit a definite programme for their approval.

The Engineers' Club (London).—The first year of existence of the Engineers' Club is now approaching completion, and it is possible to survey its record over a sufficient period to warrant an opinion thereon. The club was opened on September 1st, 1921, at 39, Coventry Street, London, W.1, as the result of some nine months' efforts on the part of the promoters; a provisional committee was formed in January last year, and early in February it met and appointed an executive committee, which set to work with vigour, under the guidance of Mr. E. L. Hill as hon. secretary—without whose stimulating enthusiasm and untiring energy the project would never have been brought to fruition. At a general meeting of the supporters of the club on June 2nd, 1921, the proposals of the Executive Committee were unanimously endorsed, Mr. E. Manville being elected the first president. At that time the number of applications received from prospective members was over 1,700; not all of these, of course, matured, but nevertheless the membership is now double that figure, and is steadily increasing—the Committee hopes to reach a membership of 4,000 by the end of this year.

The Club is situated in a central position, close to Trafalgar

Photo by [*Haines.*

Mr. Edmund L. Hill, M.I.Mech.E., M.I.E.E.
Hon. Secretary, The Engineers' Club (London).

Square, and is handsomely appointed in every respect; including the annexe, which was completely redecorated and refurnished in April last, it contains 74 bedrooms available for members, and the dining rooms can accommodate over 300 simultaneously; the latter have been in great demand for dinners and smoking concerts, the catering being recognised as unexceptionable. In connection with the Club, a golf circle, a chess circle, and a Masonic lodge have been organised; the golf circle has held four successful meetings, the Captain's prize (a silver cup presented by Mr. S. F. Corby) being won at Epsom on June 22nd by Mr. H. G. Ogden, while the President's prize (a silver cup presented by Mr. E. Manville, M.P.) will be played for in the autumn. A general meeting of all members—the first since the Club was opened—will be held early in October.

The office of President being held for one year only, Mr. Manville retires on August 31st, and the Committee, whilst gratefully acknowledging the indebtedness of the Club to him, announces that Sir Robert A. Hadfield, Bart., D.Sc., D.Met., F.R.S., M.Inst.C.E., has consented to take office. Members elected after June 30th will enjoy all the privileges of membership until August 31st, 1923.

There is no doubt that the Club has fulfilled its purpose, and has been a boon to engineers in London—including visitors from the provinces and overseas, who find it a haven of rest and a convenient rendezvous; moreover, it has been financially successful from the first, and may now be regarded as firmly established.

We have pleasure in publishing a portrait of the hon. secretary, Mr. Edmund L. Hill, M.I.Mech.E., the *genius loci*, to whom in very great measure the Club owes its existence. Mr. Hill is the youngest son of Dr. G. Birkbeck Hill, and therefore is a member of a very distinguished family, his brothers, Sir Norman Hill, Bart., and Sir Maurice Hill, G.C.B., having attained high distinction in the law as solicitor and judge respectively. He was educated at Haileybury, and received his engineering training in the L.B. & S.C. locomotive works at Brighton. His temperament has been described as "very dynamical," and accordingly after passing through the shops he transferred his energies to electrical engineering, founding the firm of Hill, Upton & Co., electrical engineers, at Oxford, which is still in existence under its original style. The next phase of his career was developed with the South Wales Electrical Power Distribution Co., where his literary talents had free play. Afterwards he became Messrs. Siemens's branch manager at Manchester, a post which he occupied for 10 years, and it was during this period that the Manchester Engineers' Club was successfully started. Mr. Hill was one of the founders, and for some years hon. secretary of this institution, which was the prototype of the London Club. In 1917 he became general secretary of the Federation of British Industries, and during his tenure of that office the membership of the Federation was increased from 400 to 1,200, a fact which bears testimony both to his personal charm and to the driving force of his character. In that capacity he greatly extended his already wide circle of friends—indeed, there are few men in the engineering industry who can lay claim to greater popularity, and certainly there is not one more admirably fitted for the post which he occupies. We print an effusion from one of his admirers, a strong supporter of both the Engineers' Clubs, which affords some indication of the esteem in which he is held.

The Pusher.—

There are some men who can't keep still,
And one of these is Edmund Hill.
His hobby, in the last few years,
Is making clubs for engineers.
In Manchester he tried his hand,
And the result is simply grand.
In London next they dragged him in,
And Edmund scored another win.
The British Trade Ship's now his toy,
So all his pals shout "Ship ahoy!"
In short, whate'er new stunt he tries,
It lives, the opposition dies.
So here's a tip for politicians,
Wee Frees, Die Hards and Coalitions.
Cut out Lloyd George and start anew,
Let Edmund pull the Nation through.

J. H. C. B.

London's New "County Hall."—The London County Council's new building, known as "The County Hall," has been growing since 1912, when the King laid the foundation stone, and was formally opened by His Majesty on Monday last, the 17th instant. It is within the area of supply of the London Electric Supply Corporation, and will be fitted with a 10,000-volt transformer sub-station having a capacity of 750 kW., connected with two extra-high-pressure feeders from Deptford; this will deal with the main lighting supply, which is distributed throughout the building on the three-wire system at 210/420 volts. There is a stand-by supply connected to the mains of the Westminster Electric Supply Corporation (with which a booster is put in circuit); the Council Chamber and main corridors will have some lamps connected to this supply. There is also a d.c. power supply (L.E.S.) at 460 volts, from which the lifts, ventilating fans, pumps, and other motors are worked.

The installation generally has been carried out by the builders, Messrs. Holland, Hannen & Cubitts, Ltd., through whom sub-contracts were entered into as follows:—For mains, cables and wires, Messrs. Pirelli-General Cable Works, Ltd., and Messrs. Hoopers; switches, Ediswan; lamps, Siemens; switchboards, Dorman & Smith; fittings, Faraday & Son, Osler, Galsworthy, Broomsgrove Guild, Davis-Cash, Best & Lloyd, General Electric Co.; lightning conductors, W. J. Furse & Co.; lifts, the Express Lift Co. and Messrs. Waygood-Otis; annunciators, The Express Telegraph Co.; electric clocks (of which 700 will be fitted), Messrs. Gillet & Johnston, Croydon; electric motors, Messrs. Crompton and Co.; whilst the Sterling Telephone Co. has supplied a specially designed system of electric bells for calling "divisions."

In a subsequent article some details will be given of the various items included in this brief summary; the installation represents thoroughly up-to-date practice in the electrical equipment of an important building.

(*Continued on page 94.*)

THE SUPPLY OF ELECTRICITY TO PARIS.

THE UNION D'ÉLECTRICITÉ AND THE POWER STATION OF GENNEVILLIERS.

Our highly-esteemed contemporary, *La Revue Industrielle*, has published, under the title "L'Union d'Electricité et la Centrale de Gennevilliers," a work by M. Ernest Mercier, general manager of L'Union Electricité, describing the circumstances in which the new power station was projected, the plant installed therein, and the methods adopted for supplying electricity to the metropolitan area. We have already, with the assistance of the journal above named and of the Union, described the generating plant, and the general arrangement of the power station (Electrical Review, April 14th, 1922), and we are now enabled by the courtesy of our confrères of *La Revue Industrielle* to reproduce a number of photographs and to give additional particulars regarding the undertaking.

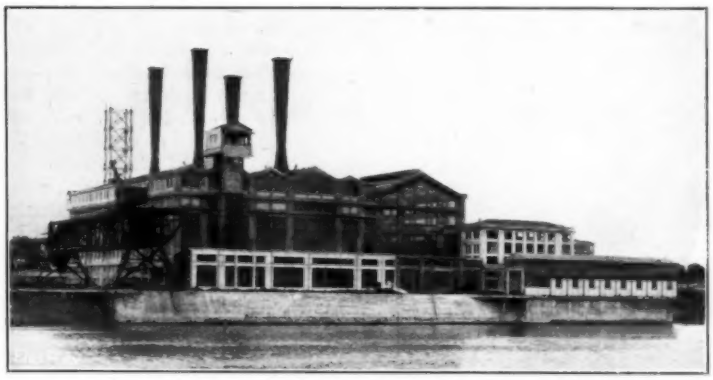


Fig. 1.—The Power Station of Gennevilliers.

During the war, in France as in Great Britain, the imperative demands of the fighting forces for supplies of munitions necessitated an immense effort on the part of manufacturers which could only be sustained by the aid of electric power in unlimited amount; there, too, the war revealed the importance of electricity to industry as well as the defects of the existing organisation, which, in Paris as in London, was heterogeneous and to a high degree uncoordinated. Consequently, in 1918, the Ministry of Public Works set on foot a national scheme for the reorganisation of electricity supply, with a standard frequency of 50 cycles per second, and a vast network of mains interconnecting the principal generating stations.

There were at that time eight companies supplying electricity to Paris and its suburbs, besides two municipal refuse destructors leased to companies; the total capacity of the generating plant, in eleven power stations, was 426,000 kW (exclusive of the destructors), all two-phase or three-phase.

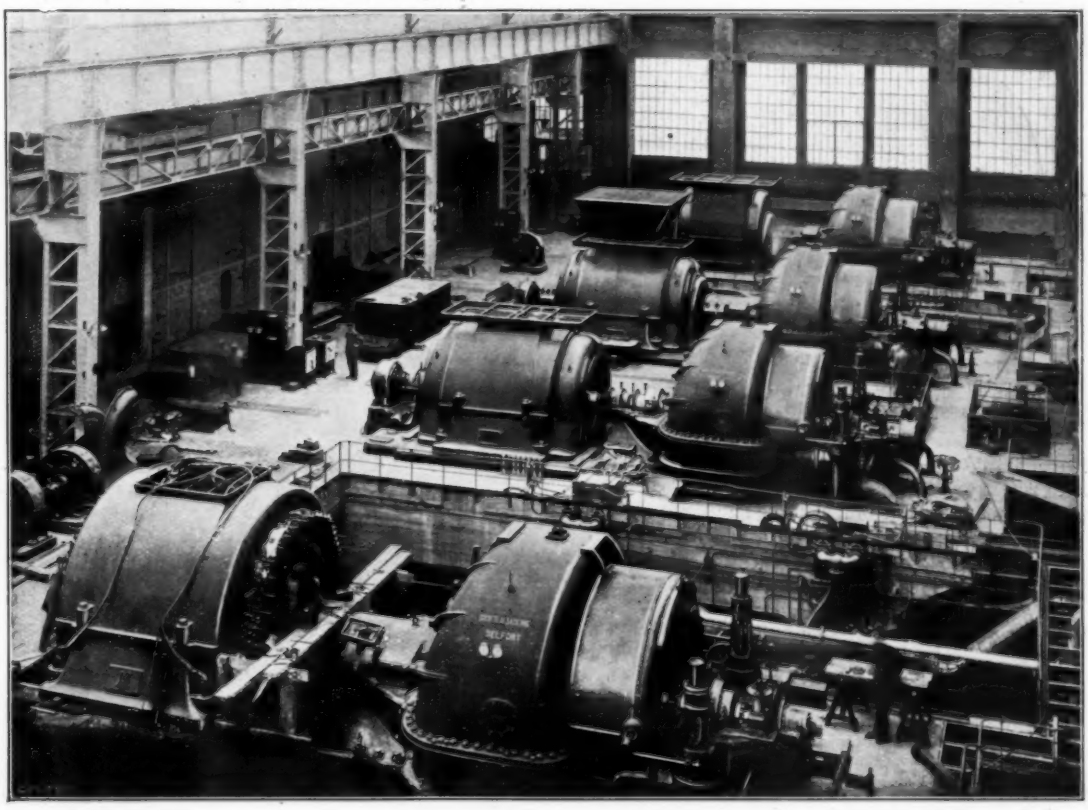


Fig. 2.—Interior of Turbine-Room.

Early in 1919 the Union Française d'Electricité was formed to embrace all these undertakings and ultimately to arrive at a uniform standard three-phase supply, besides relieving them of the generation of electricity

and paving the way to the future introduction of hydro-electric power. With the exception of the Compagnie

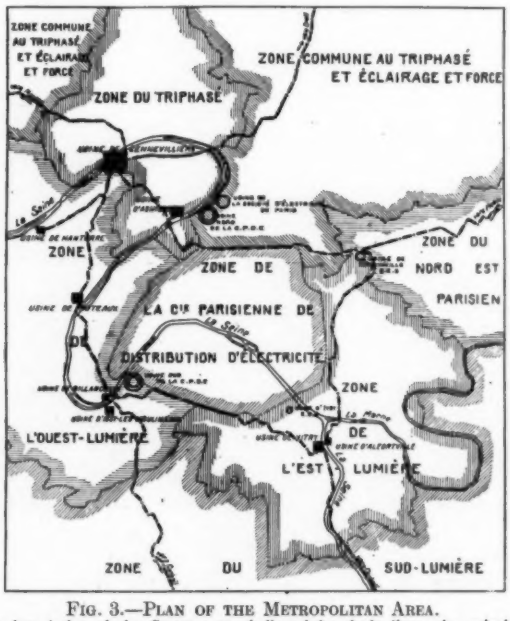

ZONE COMMUNE AU TRIPHASÉ ET ÉCLAIRAGE ET FORCE
ZONE COMMUNE AU TRIPHASÉ ET ÉCLAIRAGE ET FORCE
ZONE DU TRIPHASÉ
ZONE
ZONE DE
ZONE DU NORD EST PARISIEN
LA Cie PARISIENNE DE DISTRIBUTION D'ÉLECTRICITÉ
ZONE DE L'OUEST-LUMIÈRE
ZONE DE L'EST LUMIÈRE
ZONE DU SUD-LUMIÈRE

FIG. 3.—PLAN OF THE METROPOLITAN AREA.
The boundaries of the Secteurs are indicated by shade lines, the principal power stations by squares (Union) and circles (non-Union), and the routes of the 60,000-V mains by chain-dotted lines.

Parisienne de Distribution d'Electricité, which holds a concession from the City of Paris, and the Société

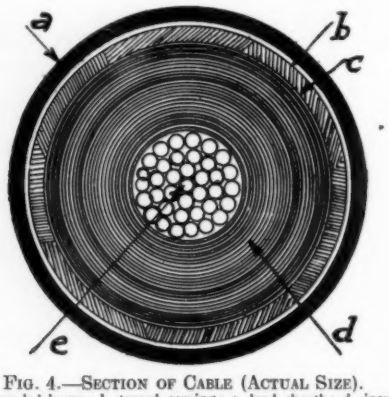


FIG. 4.—SECTION OF CABLE (ACTUAL SIZE).
a, compounded hemp; *b*, tarred serving; *c* lead sheath; *d*, insulation; *e*, conductor.

d'Electricité de Paris, which supplies energy mainly to electric railways and tramways, and to the former concern, all the undertakings lent their support to the new programme. In the course of the year 1919 the Union Française amalgamated with, absorbed, or concluded agreements with the six companies, and, under the style of Union d'Electricité, assumed ownership of their power stations, shown as black squares on the accompanying plan (fig. 3), which also indicates in chain dots the 60,000-V network. Work was commenced on the new power station in the summer of 1920, and the first set was under test 18 months later, whilst extensions undertaken in the existing power stations resulted in the installation of more than 100,000 kW of turbo-alternators of the most modern type, to meet the increased demand for electricity. The distribution network, which is in course of construction, will be fed by the power stations of Gennevilliers (200,000 kW), Vitry (80,000 kW), Nanterre (20,000 kW), Issy-les-Moulineaux (31,000 kW), and Eguzon (40,000 kW, hydro-electric, in course of construction), whilst those at Alfortville, Asnières, Billancourt, and Puteaux, aggregating 152,000 kW, will be shut down as the new supply becomes available.

Overhead lines being impracticable, except in the outer districts, and the radius of distribution being 50 km., it was thought necessary to adopt the highest pressure for which underground cables could be made, namely, 60,000 V, which was chosen after most careful investigations had been carried on over a period of two years. Single-core cables were found to be safer and cheaper than three-core, and had the advantage that the actual pressure between core and earth was $60{,}000/\sqrt{3} = 35{,}000$ V, at which pressure thousands of kilometres of cable are operating satisfactorily. The three cables composing each feeder are laid together in contact, as shown in the section of the reinforced concrete trough (fig. 5). Joints are enclosed in lead sleeves filled with compound. The Merz-Price system of protection has been adopted, and the neutral point is earthed; telephone lines enclosed in the pilot cables connect the various sub-stations with the load dispatcher's office. The total length of the 60,000-V ring-main round Paris will be 125 km. The feeders have a uniform cross section of 150 mm.² per core, and carry a normal load of 30,000 kVA. The loss due to eddy currents in the lead sheathing is less than one-sixth of the corresponding loss in the copper, and the loss in the dielectric is about 900 W per km. of three-phase feeder.

The overhead mains are to radiate to Creil (55 km.), Mantes (45 km), Orléans (110 km.), and Meaux (40 km.), the total length being 250 km. The Paris-Creil line, illustrated in fig. 7 is complete; it consists of two 60,000-V three-phase lines carried on reinforced concrete poles, the conductors being of aluminium, of 150 mm.² cross-section. The Paris-Corbeil-Orléans line will form part of an extra-high-pressure system in connection with the hydro-electric works of Eguzon, on the Creuse, which will cost 38 million francs. Throughout, the ultimate supply of electricity from the Rhône, the

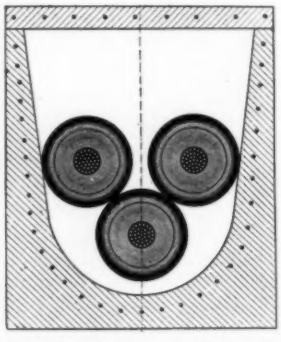


FIG. 5.—SECTION OF CONCRETE TROUGH AND THREE-PHASE FEEDER.

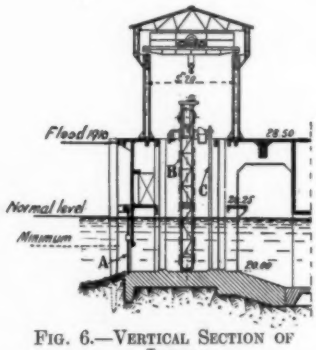


FIG. 6.—VERTICAL SECTION OF INTAKE.
A, coarse screen;
B, revolving screen;
C, safety screen.

Rhine, or the Massif Central, has been kept in view.

A general account of the power station of Gennevilliers

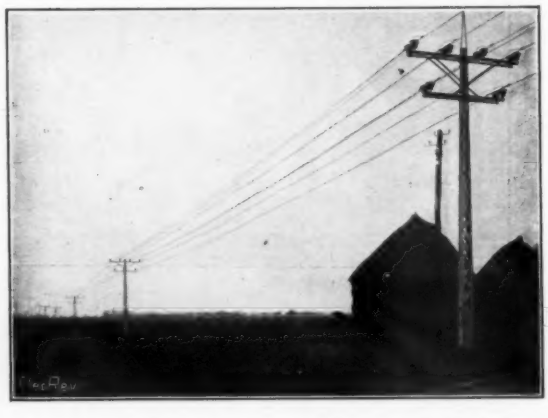


FIG. 7.—PARIS-CREIL TRANSMISSION LINE, AT 60,000 VOLTS.

having been given in our previous article, we need only supplement it with particulars not there included.

The site, comprised between the State railway from Paris to Rouen and the River Seine, is admirably situated for the supply of coal and water; barges of 1,000 tons can be berthed at the wharf, which is 160 m. in length, and can be extended to 400 m. The coal store is parallel with the river bank, measures 40 m. × 300 m., and can accommodate 60,000 tons of fuel, part of which can be submerged. The works can be extended in any direction, and a clear space of three hectares (7½ acres) has been reserved for the future terminal of the pro-

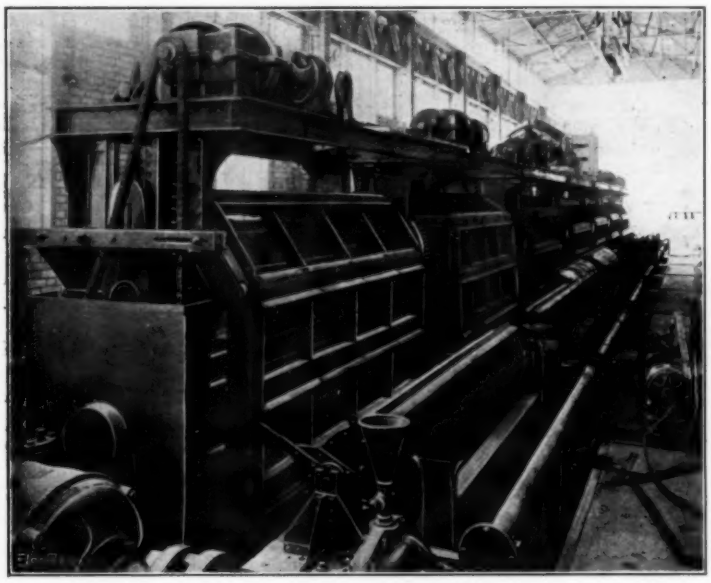


FIG. 8.—REVOLVING SCREENS.

jected 150,000-V lines from hydro-electric generating stations. The intake for circulating water is situated 130 m. up-stream from the discharge; the river is here 150 m. wide, and the quantity of water is sufficient to enable the works to run at full load (250,000 kW) for three hours without raising the temperature of the water more than 4 deg. C., even if the river were to stop flowing. At the intake mechanical screens are provided, as shown in fig. 6, in section, and in fig. 8, consisting of seven compartments provided with coarse movable gratings, revolving screens which are cleaned with water jets, and stationary screens which come into use when the revolving screens are being overhauled. The screens are driven by motors, and are housed in a building furnished with a travelling crane.

In designing the power station the engineers aimed at securing the maximum efficiency attainable without excessive complications, and the lowest cost without sacrificing reliability. The normal annual output within a few years will be 600 million kWh, and with coal at 60 francs a ton, a saving of 1 per cent. represents about 400,000 francs. With these considerations in view, the working steam pressure of 25 kg./cm.² (356 lb. per sq. in.) was chosen as the most advantageous for steam turbines, the thermodynamic gain due to higher pressures being counterbalanced by mechanical losses; the turbines, however, can give their full output with a pressure of 284 lb. The temperature of superheat was limited to 400 deg. C. by the properties of the materials used, and to provide a margin of safety the temperature at the stop valve was fixed between 350 and 375 degrees, which had been found quite satisfactory with cast-iron turbine casings at the Asnières works during several years.

For the turbo-generators the rating of 40,000 kW was suitable for the service conditions, especially the night load, and was considered the maximum consistent with reliability for single-cylinder turbines, running at 1,500 r.p.m. This output was found the best in point of economy, running cost, and initial outlay. The alternators generate at 6,000 V, but switchgear at that pressure was out of the question, and it was decided to couple each alternator directly to a transformer raising the pressure to 60,000 V. Consequently all the switchgear operates at that pressure, and presented no special difficulties of construction.

In order to cope with a wide range of fuel, a mixed boiler equipment was adopted—half the boilers of the Stirling type with Riley stokers, and half of the Babcock and Wilcox type with B. & W. stokers.

For the thermal scheme the Union surveyed minutely the various known arrangements, and adopted what appeared to be the best compromise between them in view of the requirements of economy, reliability, and simplicity. For this reason the auxiliaries are driven by electric motors fed from the main switchboard, but an adequate reserve of apparatus driven by separate steam turbines has been provided, and, in addition, two auxiliary turbo-generators of 3,000 kW each have been installed, either of which can supply sufficient power to maintain in operation the auxiliaries which are essential to continuity of service, or the whole of the auxiliaries required for the night load, when only one main generating set will be running.

The main turbines are bled at two stages, the steam extracted being used in auxiliary condensers to heat the condensate, and raising the temperature of the latter to 85 deg. C. at full load or 70 deg. at half load. The exhaust steam from some steam feed pumps, constantly

FIG. 9.—CONDENSING PLANT.

in operation, further raises the feed temperature to 100 deg., but special regulating devices ensure that this temperature is not exceeded, to prevent loss of heat. Entering the economisers at 100 deg., the feed water leaves them at about 160 deg., the heating surface being increased to suit this temperature range. Under these conditions the temperature of the gases leaving the economiser will be 220 deg., which is too high a value for enomomy; hence an air heater is installed at the economiser outlet, raising the temperature of the air for the furnaces to 90 deg., and lowering that of the waste gases to 150 deg.

No attempt was made to reduce the capital cost by parsimony of material or apparatus; but the concentration of power in large sets has led to notable savings in the civil engineering works, the pipe-work, the losses in piping, and the cost of its maintenance; in the same way the losses by radiation and the cost of upkeep of the economisers have been minimised by designing them so as to reduce their volume, and by erecting them above the boilers. Similarly the circulating water channels, which in a station of this magnitude reach large

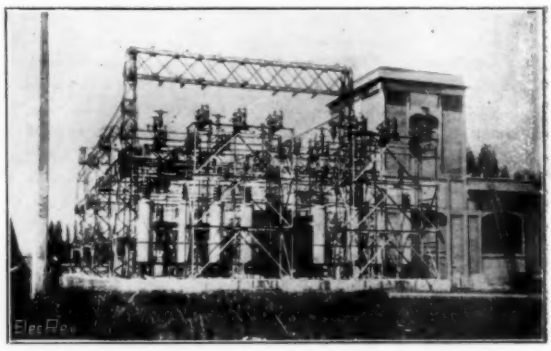


Fig. 12.—General View of Creil Switchgear and Sub-station.

dimensions, have been reduced to the minimum. Naturally, the buildings and other works are devoid of useless ornamentation; but architectural amenities have been preserved in the general outlines and ensemble of the structures.

All the details of construction have been worked out by the company's own staff, and each item of plant has been separately ordered in the most favourable market; moreover, a large workshop, covering 2,000 m.², has been built on the site, in which a great part of the boiler work and pipe work, structural steel work, &c., has been accomplished, with a material saving of time and of supplementary expenses.

Fig. 10.—Interior of 60,000-volt Switch-house.

We have already illustrated the turbines and alternators, and given vertical sections of the power station; the accompanying illustrations show the turbine room and switchgear. Briefly recapitulating, all the five sets, though made by three firms, are identical in design, the turbines being of the Zoelly type. Space is provided for a sixth set, and the lay-out provides for the addition of two more. The guaranteed consumpfion of steam per kWh, without bleeding, is 4.37 kg. (9.6 lb.) at full load, 4.3 at ¾, 4.5 at ½, and 5 at ¼ load. With bleeding, the coal consumption is reduced by 4 per cent. The condensers have each a cooling surface of 3,500 m.² (37,670 sq. ft.) and the two circulating pumps each supply 6,750 tons of water per hour. Each pump is driven by an induction motor, but one in each group is also provided with a steam turbine

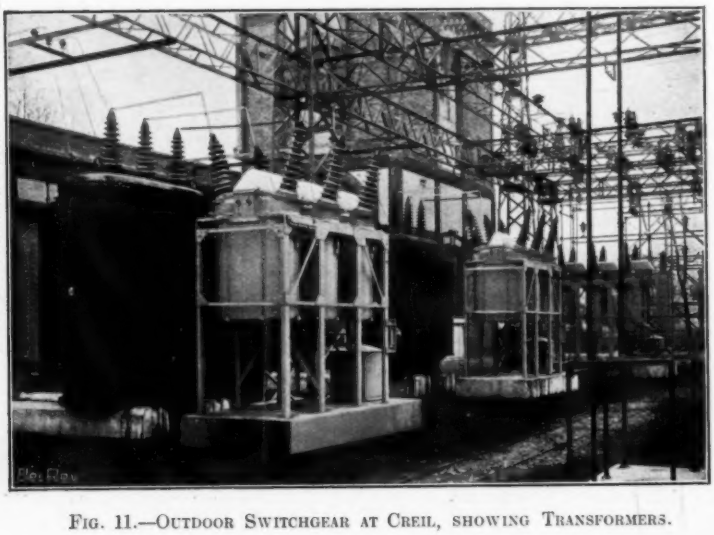


Fig. 11.—Outdoor Switchgear at Creil, showing Transformers.

as stand-by. The extraction pumps are in duplicate, motor driven, each rated at 200 m.³ of water per hour, and air is extracted by two steam ejectors, with a special starting ejector. The guaranteed vacuum with water at 15 deg. C. is 96.5 per cent. The air for cooling the alternators flows in a closed circuit, and is cooled by the condensate in a tubular cooler; fresh air can also be used, one filter being provided capable of supplying four sets simultaneously. Two turbo-alternators of 3,000 kW each, running at 3,000 r.p.m., 3,000 V, are installed to supply power to the auxiliaries in case of need.

All motors above 50 kW are fed from the 3,000-V circuit, smaller a.c. motors being supplied with energy at 220 V. The motors driving the screens, fans, and cranes, &c., are d.c., supplied at 500 V. Normally, the power for the auxiliaries is derived from the mains, through step-down transformers, rotary converters and a storage battery being provided for the d.c. supply. Stand-by excitation is furnished by the battery or by independent exciters.

The main steam pipes are of weldless steel, 254 mm. in diameter; each boiler is connected directly to a steam separator, to which are coupled two 254-mm. pipes feeding the corresponding turbine, and two longitudinal pipes of the same size. The whole of the piping and valves are installed on a special floor between the stoking floor and the basement, and the valves are controlled from the stoking floor, so that in case of accident to the piping the valves can be actuated without danger from escaping steam.

The condensate from the turbines passes through the alternator air coolers, then through an oil cooler, and through heaters supplied with steam bled from the main turbines, thus attaining a temperature of 90 deg. at full load, 75 deg. at half load. It then passes into one of three hot-wells of 123 m.³ capacity, which receive the exhaust from the steam feed pumps, the auxiliary reserve turbines, and steam bled from the 3,000-kW turbines, reaching a final temperature of 100 degrees. Six degassing apparatus are provided (four of 200 tons and two of 50 tons) in which the hot water is deprived of all dissolved oxygen and carbon dioxide before it is pumped into the economisers. There are nine feed pumps, of which six are driven by 420-h.p. motors and three by steam engines, the output of each being 225 tons per hour. Special water services are provided for fire extinction and for cleansing, the condensers being furnished with a device patented by the Société Alsacienne, which enables the interior of the tubes to be cleaned with water jets without stopping the operation of the condenser. A vacuum cleaning system pervades the whole of the works, and the oil store and oil cleaning plant is served by a complete system of piping and pumps.

The plant is electrically divided into as many sections as there are generating sets, each section being controlled by one main circuit-breaker, three selector switches, six feeder circuit-breakers (two to each feeder), three 60,000-V reactance coils, and one sectioning circuit-breaker. All the breakers (except the selectors) are alike, their normal rupturing capacity being 600,000 kW. The alternator circuit-breakers are automatic, but do not operate on overload, the generators being able to carry their short-circuit current with full excitation; the circuit is interrupted only in case of internal injury to the alternator or transformer. Each circuit-breaker is mounted on a pedestal which contains a vat capable of holding the oil from all three tanks, the whole being enclosed in a casing of sheet iron 8 mm. thick. The reactance coils are immersed in oil in copper tanks with bronze bottoms and covers, the windings being held in place with bronze bolts and spring washers. The whole of the switchgear is of the outdoor type, but is covered with a light structure of reinforced concrete, a gallery affording ready access to the conductors and insulators.

The low-pressure switchgear is housed in a large building between the turbine-room and the high-pressure switchgear; here also is situated the "load dispatcher's" office or control room.

The step-up transformers are contained in a range of cubicles running the length of the turbine-room; each cubicle is provided with an outlet for smoke in case of fire, and a reservoir beneath it capable of containing the whole of the oil in the transformer tank.

Mechanical, chemical, and electrical laboratories are provided, the last being furnished with a rotary converter of 6,000-kVA, and a transformer for testing cables at double the normal pressure.

In the well-equipped mechanical workshop there is an electrically heated oven for repairing electrical apparatus, capable of receiving the complete rotor of an alternator; a smaller oven is also to be installed.

The turbine-room is served by two cranes, of 100 and 20 tons respectively, and the transformer gallery by one of 40 tons.

The coal-handling plant is naturally planned on a large scale; it provides for the reception of 400 tons per hour from barges, which can be put into store or sent direct to the boiler-house bunkers, which have a capacity of 3,800 tons, and for the delivery of coal by rail. Soot is collected from the boilers, economisers, and air-heaters by a pneumatic system, and ashes are removed by battery-driven trucks each of 40 tons capacity, for dispatch by rail or by water.

Very special attention has been given to the welfare of the personnel; cloak-rooms, baths, a first-aid room, and a canteen are provided, as well as dwellings for the staff, and the whole of these are equipped exclusively with electric cooking and heating apparatus.

The buildings were erected on piles of reinforced concrete, over 2,000 in number; the turbine-room is steel-framed, and the boiler-house and switchgear house are of reinforced concrete. By the liberal use of exceptionally powerful machinery, and a large staff of men, numbering 1,300 for some months, the work of erection was carried out in a remarkably short time.

The total cost of the power station, equipped with plant of 200,000 kW, will be less than 600 francs per kW, and when the capacity is increased to 280,000 kW the cost per kW will be reduced to 530 francs. These figures respectively correspond to £11.2 and £10 at the present rate of exchange, but it should be borne in mind that the international exchange does not truly represent the value of money raised and spent in France.

In conclusion, in the course of two or three years the Union d'Electricité will have available in the four power stations (Gennevilliers, Vitry, Nanterre, and Issy-les-Moulineaux) plant of an aggregate capacity exceeding 400,000 kW. It has demonstrated the advantages of centralisation of plant, and has shown how, in a country too often assumed to be saturated with individualism, the spirit of co-operation has developed and the most diversified interests have been quickly and effectively organised for joint action. M. Ernest Mercier, Administrateur-Délégué of the Union, accords well-earned thanks to M. Gustave Mercier, civil engineer, M. A. de Casanova, chief engineer, and M. Couffon, chief electrical engineer, as well as to other members of the engineering staff, for the loyalty and devotion which they have displayed in carrying out this great undertaking.

The British Cast-Iron Research Association.—During the past month investigations of a varied character have been carried out on behalf of the members of the Association. The larger research works which are being carried out by the director are being pushed forward, and very valuable data collected. A special committee has been appointed to carry out a thorough investigation in connection with malleable iron castings. The first bulletin, giving full details of the researches already carried out, is now being issued to the members. The membership of the Association is increasing, and foundries are taking a keener interest in its work.

The Association has published a small pamphlet setting forth its aims and objects, and its constitution. Several ways in which it can help manufacturers are suggested. Its offices are at Central House, New Street, Birmingham.

NOTES.

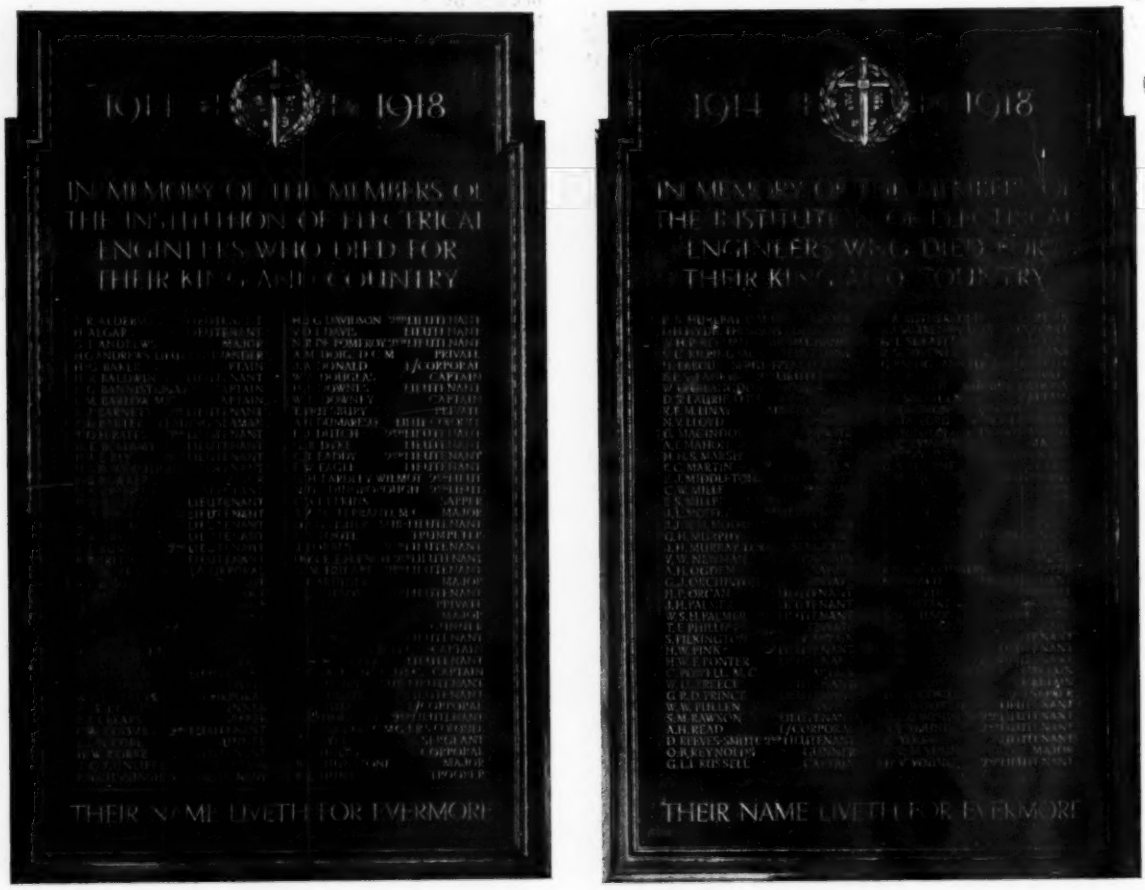
(*Continued from page* 88).

Appointments Vacant.—Jointer (district rate), for Peterborough Electricity Department; shift engineer (Class C, Schedule 8), for Wimbledon Electricity Department; foreman (£440-£12-£500), for the Nigerian Posts and Telegraphs Department. (See our advertisement pages to-day.)

Tram-route Indicator.—The *Daily Express* states that some London tramcars have been fitted with an ingenious locality indicator, consisting of a moving tape running on rollers, which synchronises with the route. An indicator shows on the tape the exact position of the tramcar at any particular moment. Disks on the tape not only show cross-roads and stopping-places, but have the fare-stages marked on them. The half-mile of route in advance is shown on the tape and the half-mile just traversed.

A hundred of these useful machines are being installed on the Metropolitan electric tramcars to Palmers Green and Enfield.

The War Memorial of the Institution of Electrical Engineers.—In our issue of June 30th (p. 921) we described the ceremony of unveiling the memorial which has been erected by the Institution of Electrical Engineers to its members who gave their lives in the war. We now reproduce photographs of the large bronze tablets, which are fixed to the marble walls on either side of the entrance hall, and bear the names and rank of the members who thus conferred honour upon the body to which they belonged, at the cost of the supreme sacrifice. In the words of the memorial, "Their name liveth for evermore."



The War Memorial of the Institution of Electrical Engineers.

The German Briquetting Experts for Morwell.—The *Melbourne Age* of May 23rd, publishes the following:—"The State Government has been faced with many problems regarding the six German engineers who were engaged some months ago to assemble the briquetting plant of the Morwell power scheme, and to instruct the Victorian engineers and workmen to handle it. After the opposition of the Prime Minister to their admission to the Commonwealth had been overcome, it was considered that the Electricity Commissioners would have no further trouble in securing the experts. But apparently the opposition of the Prime Minister is still a formidable thing in parts of Germany; at all events, further delay has occurred in securing the services of the German experts. As the result of cable messages, which have been passing between the Electricity Commissioners and the experts, however, it is not anticipated that there will be any additional hindrance. It is understood that the German engineers have been assured that they need fear no hostility on their arrival in Victoria. They appear to have thought that such an assurance was necessary in view of the hostile attitude which was adopted by Mr. Hughes."

Automatic Train Control.—An experiment has been made on the Paris-Orleans Railway, says the *Evening News*, with a new apparatus which is the invention of the French engineer Rodolausse. The apparatus is intended to control and regulate automatically the speed of the train and to limit it to a maximum speed previously provided for; to stop the train in case the driver fails to apply the brakes at a signal, and to reduce or accelerate automatically.

London's Electric Signs.—*The Times* states that the Westminster City Council is determined that there shall be no second Broadway in the area under its control and is therefore seeking to prohibit the erection and maintenance of electric signs. The ostensible reason for this attitude is that a number of these overhang the public way and constitute a source of danger. Our contemporary points out that the proprietors of the signs in Piccadilly pay between four and five thousand pounds per annum in rates besides providing employment to fifteen or twenty men; this is apart from the value of the work to the manufacturing industries concerned.

The Trade Revival.—There is sardonic humour in the following inquiry—"the only genuine one for a day or so"—received by a Midland firm of electrical engineers this week: "Gentlemen.—Have you any job lines in advertising novelties which would be suitable for lucky bags; if so, will you send me samples and quote me lowest price per gross, and oblige, &c."

Extension of the Metric System.—The Federal Council has asked the Swiss Parliament to ratify the decision of the Paris Weights and Measures Conference of October, 1921, at which 27 States were represented. The decision in question was intended to amend the Metric Convention of May 20th, 1875, by extending the activities of the International Bureau of Weights and Measures to other units than those of length and volume, and especially to electrical units.—*Reuter.*

High-speed Photography.—M. Bull, of the Marey Institute, Paris, has described to the French Academy of Science the means by which he has been successful in obtaining 250 kinematograph photographs of the usual size in one-hundredth of a second—a rate of 25,000 pictures a second. In order to achieve this extraordinary speed the inventor caused a prism to revolve at the rate of 100 revolutions a second, which being lighted by a succession of electric sparks, "threw" the pictures on to a stationary film. It is interesting to know that this development, which is full of significance to the kinema world, was worked out at the institute founded to carry on the work of the scientist Marey, whose studies formed the starting point for "moving pictures."—*Evening News.*

Standardisation of Electrical Equipment in Australia.—In response to the pleadings of a deputation representative of the engineering and chemical trades, the Australian Minister for Customs has requested the Director of the Bureau of Science and Industry to investigate and report upon the practicability of standardising electrical equipment. It was pointed out that if Australians were to produce goods of a quality and at a price comparable with those produced by their competitors in different parts of the world the adoption of standardisation principles was essential.—*Reuter's Trade Service* (Melbourne).

Service Notes.—Captain C. E. Kennedy-Purvis, R.N., has been posted to the Admiralty for service with the Wireless Board. Brevet Lt.-Col. D. S. Collins, D.S.O., Royal Engineers, has been appointed chief instructor at the School of Electric Lighting, in succession to Major P. S. Watkins, D.S.O. Lt.-Col. Collins is well known as a leading expert on electric lighting.

Birmingham Electrical Golfing Society.—The seventeenth meeting of this Society was held on the Little Aston Golf Course in fine weather. The Bayliss Cup, which was up for competition, was won by Mr. J. H. Berry, with Mr. W. A. Baxter second and Mr. W. A. Jackson third. The Sealed Nine Holes was won by Mr. W. A. Millinger. The autumn meeting will be held about the end of September, when the "Dr. Railing" Cup will be up for competition. Golfers in the Midland electrical industry can obtain full particulars of the next meeting, also the 1923 programme, on application to the hon. secretary at 9, Livery Street, Birmingham.

Legal.—THE KING *v.* THE ELECTRICITY COMMISSIONERS (*ex parte* the Ealing Borough Council).—In Appeal Court II on Wednesday this part-heard case was continued, and at the conclusion of the arguments, their Lordships allowed the Electricity Commissioners' appeal, and discharged the rule.

The hearing in the Divisional Court was reported in the ELECTRICAL REVIEW for June 2nd, 1922, p. 766.

Association of Consulting Engineers.—The latest list of members, professional rules, &c., has come to hand, showing a total membership of 85. The names of officers and committee members for 1922-23 appear.

Educational.—UNIVERSITY OF LONDON: KING'S COLLEGE.—Considerable extensions have been made in the Engineering Department of King's College, including a large drawing office, lecture-room and laboratory for hydraulics and strength of materials; and electrical engineering research rooms, including wireless telegraphy. The four years' course of study in engineering provides opportunities for practical training in works.

UNIVERSITY COLLEGE, LONDON.—Diplomas in electrical engineering have been awarded in the Faculty of Engineering to N. Axford, L. T. Bird, A. J. Emery, A. N. Jackson, W. F. Marriage, D. C. North, and W. J. Webb.

The Hydro-Electric System of Ontario.—In a report prepared by Mr. W. S. Murray and published by the National Electric Light Association, U.S.A., the system of the Hydro-Electric Power Commission of Ontario (the largest government-owned system in existence) is criticised as being inefficient, expensive, and wasteful, and it is contended that service rendered by privately-owned undertakings is cheaper and better. Mr. Murray points out that 87 per cent. of the Power Commission's output is generated at Niagara, where the conditions are most favourable to cheap production of energy. The Commission has exceptional administrative powers, and no law-suit can be brought against it without the fiat of the Attorney-General, which has never been granted. All its property is tax-free, except land, whereas private companies pay 7.1 per cent. of their income in taxation.

In 1920 the Province of Ontario owned one-half of its electricity supply undertakings, and received two-thirds of the total revenue from electricity supply; the Province of Quebec, on the other hand, owned only 4 per cent. of the undertakings, and received 5 per cent. of the revenue. The income per dollar of salaries and wages paid was 32.5 per cent. higher in Quebec than in Ontario, and the cost to the consumer per kilowatt-hour generated averaged 0.66 cent in Quebec (96 per cent. private undertakings) compared with 0.878 cent. in Ontario (50 per cent. private undertakings), whilst in the latter case the government-owned undertakings supplied at 0.925 cent. as compared with the private undertakings at 0.76 cent. The average revenue per kilowatt-hour generated for the American Niagara power district was about 17 per cent. less than that of the Hydro-Electric Power Commission; and the average cost of power retailed to the public in the Niagara district by the Canadian municipalities served by the Commission was 67 per cent. more than on the American side. The average cost of power to the people of Quebec was 32 per cent. less per kilowatt-hour generated than to the consumers in the Canadian Niagara district. With regard to the new Queenston-Chippawa development, with an ultimate capacity estimated at from 495,000 to 650,000 h.p., whereas the Commission formerly purchased 100,000 h.p. from the Ontario Power Co. at slightly more than $9 per horse-power-year, the cost of supply to the municipalities of Ontario from Queenston will be $28.05 per h.p.-year, plus $9.40 for transmission from Niagara Falls, or $37.45 in all. This, says Mr. Murray, is an increase over the cost of $19.80 per h.p. year stated by the Commission in its 1920 report of $17.65 per h.p.-year, or 89 per cent. The increase in production cost per h.p.-year at the point of delivery to the Niagara system from $10.40 for 1920 to $28.05 amounts to approximately 170 per cent.—*Electrical World.*

A New X-ray Protective Material.—The necessity for improved protective material in connection with radiological work has arisen from the work of the Protection Committee, and Mr. H. C. Head, M.I.E.E., points out in the *Journal* of the Röntgen Society, that his firm, in co-operation with Messrs. Murray, Parkyn & Co., of Stockport, has been carrying out experiments (at the instance of Dr. Morrison, of Manchester) which have enabled them to produce a material which has been registered under the name of Parraynite, which can be claimed as a step forward in the subject. This substance is made by Messrs. Murray, Parkyn in two forms, a pliable form C and a solid form F. The former is used for such articles as aprons, nurses' overalls, the lining of existing tube-boxes, &c., while the latter can be built up or moulded in any desired shape, such as panel sections, portable screens, &c. The composition of Parraynite is a trade secret, which owes much to Messrs. Muray, Parkyn's unique experience in the manufacture of ebonite. The ingredients vary, depending whether the solid or pliable form is required. Accurate and careful working is essential if the material is to function as a non-conductor, as well as possess a definite equivalent in lead. The softening point of Parraynite F is high, yet the material is not unduly brittle in its solid sheet or moulded form. Parraynite is tested electrically up to 2,500 volts for proof of non-conductiveness, this being merely a precautionary measure, as in actual fact the material will resist the much higher potentials used in X-ray work. Samples of the material have been tested at the National Physical Laboratory, when the following results were obtained: Parrynite C (pliable)—3.1 mm. thickness, equivalent to 1 mm. metallic lead. (2) 5.3 mm. thickness, equivalent to 1.7 mm. metallic lead. The results were the same whether the applied peak voltage to the tube was 100 or 120 kilovolts.

Parraynite F (solid).—9.9 mm. thickness was found to be equivalent to 1.5 mm. metallic lead with an applied voltage to the tube of 100 kilovolts, and to 1.3 mm. metallic lead with an applied voltage of 120 kilovolts.

A full-length apron made of Parraynite C, equal in protection to 1 mm. of metallic lead, although weighing about 19 lb., is far more comfortable to wear than the average lead rubber variety, on account of the special supporting system of straps designed by Mr. Glover.

Parraynite C can be produced in sheets in any reasonable length and thickness, and in any width up to 26 in. Parraynite F can be produced in sheets up to 43 in. long, any reasonable thickness and, if necessary, up to 26 in. wide. A point of interest is that Messrs. Murray, Parkyn & Co. have a special process whereby Parraynite, vulcanite, &c., can be applied to wood or metals (steel, cast-iron, &c.), the method of application ensuring a chemical bond between the product and the metal. The effectiveness of this bond has been demonstrated by means of radiography. Metal work thus covered or lined is tested electrically up to 2,500 volts, to ensure that the covering is effective and free from porosity.

A False Accusation.—At Gedburgh, last week, Harry Smith, Leeds, was sentenced to three years' penal servitude on being convicted of charges in connection with fire raising at a Hawick mansion house with intent to defraud an insurance company. One of the arguments for the defence was that the cause of the fire was probably a defect in the electrical installation. Mr. W. E. Townsend, electrical engineer, Edinburgh, said the installation was obviously an old one. Wherever he could see, the wires were in wooden casing, but where a ladder was necessary there was no casing to be found. The joints he had seen were so bad that he was not surprised at all that a fire took place. In cross-examination, he agreed that the mere fact that an installation was twenty years old did not call for its condemnation. Prof. F. G. Baily, Heriot Watt College, Edinburgh, also gave evidence as to the electrical installation. The verdict, however, was one of "Not guilty" for the electrical installation.

Electrical Treatment of Vegetables.—Experiments in electro-culture were made at Bellevue, on the outskirts of Paris, in 1920. The results for that year and 1921 are now published. A system of field wires was laid over the ground and subjected to a powerful electric current. This was done daily from 6 to 8 o'clock, morning and evening. The results, as compared with the growth on similar ground not so treated, were as follows:—

	Electrified.	Ordinary.
Cabbages	27	25
Lettuce	10	7
Cos Lettuce	3	2
Potatoes	15	9
Leeks	6	3
Tobacco	47	68

—*The Times.*

Post Office Tube Bill.—A Select Committee of the House of Commons, presided over by Sir Fortescue Flannery, on July 12th considered a Bill promoted by the Postmaster-General to enable him to acquire for Post Office purposes a tube running from St. Martin's-le-Grand up Eversholt Street to St. Pancras. Mr. Bruce Thomas (for the Postmaster-General) explained that this Bill was promoted, says the *Morning Post*, to confirm the agreement made between the Pneumatic Despatch Co. and the Postmaster-General for the acquisition of a tube running between St. Martin's-le-Grand and St. Pancras. There was no opposition. The plan of the tube produced by counsel showed four breaks, one being at the junction of Tottenham Court Road and Oxford Street, where the Underground Railway station was situated, another at Kingsway, caused by the L.C.C. tramway subway, and another at the bottom of Gray's Inn Road, where the L.C.C. sewers cut through it. The purchase price, subject to confirmation by Parliament, would be £7,500, which, compared with current prices for the laying of a conduit, would enable him to effect a saving of approximately £42,000. The immediate use to which the Postmaster-General intended putting the tube was to lay cables from the General Post Office to Tottenham Court Road, and it was in this connection that the saving referred to would be effected. Mr. John Sinnott, Assistant Engineer-in-Chief to the General Post Office, gave evidence. The Committee decided to report the preamble of the Bill as being proved.

The Times explains that the Pneumatic Despatch Co. was formed before 1859, with the object of laying automatic tubes under the streets of London for the conveyance of parcels, messages, and dispatches. This tube was constructed in 1866, but since 1874 it has been out of use through the difficulty, it is understood, of keeping it airtight. The Engineering Department of the Post Office is satisfied there was no serious deterioration caused by corrosion.

"What is happening to the Post Office 'tube' railway constructed to carry mails and parcels between Paddington and Whitechapel?" the *Evening News* asks, and goes on to explain that up to date more than £1,000,000 has been spent on the scheme. The estimated cost of the whole scheme, when it was started in 1914, was £950,000, but as yet the electrically-driven cars which are some day to replace the street van services and expedite the delivery of mails are not in existence. The official answer for the delay is that the Post Office is holding its hand until costs fall. The tube itself is complete and ready for use, but all the tenders so far sent in for the cars and other electrical equipment have been considered too high. The object of the undertaking is to quicken and cheapen the transmission of letters and parcels between the chief post offices in east and west London. The railway will be laid in a single tube 9 ft. in diameter and 6½ miles in length, from Paddington District Post Office to the Eastern District Post Office at Whitechapel. There are intermediate stations at the western and west central district offices, the G.P.O., Broad Street, and Liverpool Street Stations, where the diameter of the tunnel is increased to 25 ft. The trains run on two narrow-gauge tracks. Between the stations these trains, which will travel at 35 miles an hour, will be controlled by distant switches. The mails will be loaded and unloaded by automatic means.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Mr. J. M. McELROY, who recently retired from the position of general manager of the Manchester Corporation tramways, was presented by the Tramways Committee on Tuesday last week with a silver tea service. The presentation, which took place at the tramway office at the conclusion of the business of the Committee, was made by the Chairman (Alderman James Bowes) in the presence of the Lord Mayor of Manchester, the Town Clerk, and the members of the Committee. The Chairman, in making the presentation, spoke of his long and harmonious association with Mr. McElroy, and said that the parting was a real wrench for him. He hoped that Mr. McElroy, as a result of his well-earned rest, would be so restored to health as still to be able to do much useful work for the industry in which he had been such a prominent figure. The Lord Mayor also paid a high tribute to Mr. McElroy for his services to the Corporation of Manchester, and to the tramway industry generally, and referred particularly to the report which Mr. McElroy had written on the "Passenger Transportation Problem," which he, the Lord Mayor, described as a text-book on the subject, and one of which Mr. McElroy and the Corporation had every reason to be proud. Several of the members of the Committee added their testimony to the great work which Mr. McElroy had done for Manchester in connection with the organisation and administration of the tramways, and they emphasised the very high example he had set by his personality during his period of office as general manager. Mr. McElroy, in responding, thanked the Committee for its kindness in making the presentation to him, and spoke of the happy relations which had always existed between the Committee, the staff, and himself during the 22 years he had been the manager; and although the parting was a sad one for him, it was made glad by the manifestations of goodwill which he had received from the members of the Committee assembled there.

Mr. W. D'ARCY MADDEN, M.I.E.E., general manager of Messrs. Hick, Hargreaves & Co., Ltd., Bolton, has joined the board of the company, and has been appointed managing director.

A sub-committee of the Dundee Corporation Electricity Committee proposed to recommend for the post of engineer and manager, in succession to Mr. Harry Richardson, Mr. DOUGLAS H. BISHOP, who has charge of the generating station at Carolina Port, at a commencing salary of £800, rising by annual increments of £50 to £1,000, the present salary of the engineer. Mr. Bishop, however, declined to be a candidate unless a commencing salary of £1,000 was guaranteed. The committee decided to recommend the Town Council to advertise the post at a commencing salary of £800 rising to £1,000. Mr. Bishop, it is stated, pointed out that the responsibility of the post was very great, and that it would damage him in the electrical world if he were to accept such an important post at the figure suggested. The convener of the committee favoured £1,000, his opinion being that if they offered a lower figure they would not get a suitable man. It was pointed out that the Electrical Engineers' Association's basic rate for Dundee was £1,300.

A Manchester paper states that Ald. DAGNALL, chairman of the Manchester Corporation Electricity Committee, has been elected chairman of the South-East Lancashire Electricity Advisory Board, and Dr. PARSHALL, a director of the Lancashire Electric Power Co,, vice-chairman.

On Saturday last, upon leaving Loughborough to take up the position of station superintendent to the Wallasey Corporation electricity works, Mr. PAUSEY was presented with a silver rose bowl suitably inscribed. The presentation was made by Councillor F. A. Stenson, chairman of the Electricity Committee, who spoke very highly of the activities of Mr. Pausey during his three years' stay in Loughborough. Mr. R. B. Leach, the chief engineer, endorsed Councillor Stenson's remarks.

Mr. R. A. CHATTOCK, chief engineer of the Birmingham electricity supply department, has been elected chairman of the District Industrial Council for the Electricity Supply Industry (No. 5), West Midlands area; Ald. J. Gregory (Labour representative) is the deputy chairman, and the office of joint secretary and treasurer for both sides of the Council will continue to be performed by Mr. E. J. Jennings (secretary of the Birmingham electricity supply department).

Mr. R. H. SELBIE, general manager of the Metropolitan Railway Co., was last week elected to a seat on the board in place of the Earl of Lauderdale, who has retired owing to ill-health. Mr. Selbie will continue in his position as general manager of the company.

At the Yale University, on June 21st, the honorary doctorate of science was conferred upon Mr. J. J. CARTY, vice-president of the American Telephone and Telegraph Co., and "a pioneer in the development of telephone science since 1879."

Mr. BERNARD L. MYER, A.M.I.E.E., of 51, Oxford Street, Liverpool, has ceased to represent Messrs. Napier-Kimber, Ltd., for the Lancashire district.

On July 14th, at Stafford, the marriage took place between Mr. J. W. ELLIOTT, B.Sc., A.M.I.E.E. (district superintendent, Cardiff, for the Edison Swan Electric Co.), only son of Mr. and Mrs. J. W. Elliott, of Enfield Highway, and Miss Nora Elsie Cooper, of Stafford. The bridegroom's father is lamp sales manager to the Edison Swan Co.

The Aberdare Council at a special meeting adopted recommendations of a committee with reference to the advertised appointment of an electrical engineer and general manager. The advertised salary was £450, plus bonus £200, per annum. In view of the transfer of the charge of the tramway department to the surveyor's department, the committee recommended that Mr. W. T. HILDER, M.Inst.E.E., the mains superintendent, to the Council, be appointed as general manager and engineer at £450 per annum, to include bonus.

They further recommended that the works superintendent to the Council, Mr. W. J. WILLIAMS, take over charge of mains as part of his duties, the salary for the joint post to be £400 per annum, including bonus. The saving to the Council by these changes was estimated at £500 a year. The Council confirmed the appointments as recommended. There were 51 applicants for the position as advertised.

Obituary.—MR. S. W. TRENTHAM.—The death is announced at Nuneaton of Mr. Sidney Wallace Trentham, younger son of the late Mr. George Trentham, public works contractor, of Birmingham. He was trained as an electrical engineer, and held appointments at Aston, Derby and Llanrwst before joining the firm of G. Percy Trentham, Ltd., public contractors, of Birmingham. Since the war, he has been the managing director of the Hartshill Quarry Co., Ltd., Atherstone.

Will.—The late Mr. JOHN TEMPLE, C.B., who was a director of several colliery and other companies, and is described as for many years acting as engineer to various cable companies in the Atlantic and the Mediterranean, left £261,597 gross and £261,248 net personalty.

NEW COMPANIES REGISTERED.

Hodgson (London), Ltd. (182,969).—Private company. Registered July 7th. Capital, £100 in £1 shares. To acquire the business of the Hodgson Manufacturing Co., and to carry on the business of inventors, patentees, mechanical and electrical engineers, manufacturers of machinery, wireless and other instruments, &c. The permanent directors are:—F. A. G. Hodgson, 37, Comeragh Road, West Kensington, W.4; H. R. Hodgson, 37, Comeragh Road, West Kensington, W.4; E. J. Mason, 51, Meath Road, Ilford, Essex. Qualification, £20. Remuneration, £15 per annum, divided between them. Secretary: W. C. Wood. Registered office: 2, Gerrard Place, Shaftesbury Avenue, W.1.

H. C. Tofield, Ltd. (183,066).—Private company. Registered July 12th. Capital, £2,000 in £1 shares. To carry on the business of electricians, electrical, mechanical, gas, water, heating, lighting, motor, and general engineers, &c. The permanent directors are:—H. C. Tofield, 111, Hagley Road, Edgbaston (chairman); Ann E. Tofield, 111, Hagley Road, Edgbaston. Qualification, £1. Remuneration of H. C. Tofield as managing director, £500 per annum. Secretary: Ann E. Tofield. Registered office: Temple Passage, Upper Temple Street, Birmingham.

Cullompton Electric Supply Co., Ltd. (183,058).—Registered July 12th. Capital, £6,000 in £1 shares. To carry on business as indicated by the title. The first directors are:—Dr. G. G. Gedley, Cullompton, Devon; Major F. G. Sellwood, M.C., Cullompton, Devon; W. Plumpton, Cullompton, Devon; W. T. Burnard, Cullompton, Devon. Minimum cash subscription, 2,500 shares. Qualification, £25. Remuneration (except managing directors), as fixed by the company. Secretary: E. Browning. Registered office: Fore Street, Cullompton, Devon.

General Engineering & Electric Welding Co., Ltd. (183,065).—Private company. Registered July 12th. Capital, £2,000 in £1 shares. To carry on the business of mechanical engineers, boiler makers, electrical engineers, ship repairers, ironfounders, machinery manufacturers, tool makers, &c. The permanent directors are:—F. Severton, 10, Oakland Road, Mumbles, Swansea; G. P. Jones, 62, Queen's Road, Mumbles, Swansea. Qualification, £250. Secretary: G. P. Jones. Solicitor: E. McDahne, Victoria Buildings, Swansea.

A. P. Steven, Ltd. (12,298).—Private company.—Registered in Edinburgh July 12th Capital, £60,000 in £1 shares. To carry on the business of makers of electric and hydraulic passenger and goods lifts of all kinds, manufacturing, civil, and mining engineers, ironfounders, &c. The first directors are:—A. Steven, 181, St. James' Road, Glasgow, engineer; J. M. Steven, 181, St. James' Road, Glasgow, engineer; M. Stephen Dick, 181, St. James' Road, Glasgow, engineer; W. J. Maclure, 181, St. James' Road, Glasgow, engineer. Qualification, 100 shares. Registered office: Provanside Works, 181, St. James' Road, Glasgow.

Bolton Wireless Installation Co., Ltd. (183,083).—Private company. Registered July 13th. Capital, £200 in 195 6 per cent. preference shares of £1 each and 100 ordinary shares of 1s. each. The objects are as indicated by the title. The first directors are:—J. Drucquer, Palace Hotel, Birkdale, Southport; D. W. Drucquer, 22, Bath Street, Bolton; R. A. Livock, "Porthleven," Blundellsands, Lancs. Qualification, five ordinary shares. Registered office: 2, Rook Street, York Stret, Manchester.

Manchester Wireless Installation Co., Ltd. (183,002).—Private company. Registered July 13th. Capital, £200 in 195 6 per cent. preference shares of £1 each and 100 ordinary shares of 1s. each. The objects and all other particulars similar to Bolton Wireless Installation Co., Ltd.

Morgan & Taylor's Radio Electric, Ltd. (183,104).—Private company. Registered July 13th. Capital, £1,000 in £1 shares. To acquire the business of a radio specialist and electrical and wireless engineer, and agent for the sale and distribution of wireless apparatus and goods carried on by A. Taylor as "Morgan & Taylor," at 146, King's Road, and 10a, Sneyd Street, Cardiff. The permanent governing directors are:—Arthur Taylor (chairman), 146, King's Road, and 10a, Sneyd Street, Cardiff; Alfred Taylor 146, King's Road, and 10a, Sneyd Street, Cardiff; G. P. Taylor, 58, Hertford Road, Bootle. Qualification of governing directors, 100 ordinary shares; of other directors, 25 ordinary shares. Solicitor: E. Horley, Andrew's Buildings, 67, Queen Street, Cardiff.

Angus Railway Control, Ltd. (182,898).—Private company. Registered July 5th. Capital, £6,000 in 1s. shares. To acquire from A. R. Angus the benefit of and turn to account certain existing inventions relating to railway safety appliances and signalling apparatus; and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in railway, electric, magnetic, galvanic, and other apparatus, &c. The first directors are: A. R. Angus, Frensham Grove, Frensham, Surrey; L. Christensen, Sandefjord, Norway; B. Aagaard, Larvick, Norway; C. Gyllensvard, Djursholm, near Stockholm, Sweden; E. P. Williams, "Redbourne," Priest's Lane, Shenfield, Essex; C. A. Fell, 47, Durham Road, East Finchley. A. R. Angus may retain office while holding 20 per cent. of the shares issued. Registered office: 66, Fenchurch Street, E.C.3.

John Richards & Co. (Electrical Engineers), Ltd. (183,000).—Private company. Registered July 10th. Capital, £6,000 in £1 shares. To acquire the business of an electrical engineer carried on by J. Richards at 9, High Street, Burton-on-Trent, and 75, Victoria Street, Westminster, S.W. The business acquired is not connected in any way with the similar electrical engineering business carried on by the said J. Richards as "John Richards & Co." at Longton. The permanent directors are:—J. Richards (chairman), "Highfields," Uttoxeter; F. Langton (managing director), "The Rise," Tatenhill, Staffs. Secretary: F. Langton. Registered office: 9, High Street, Burton-on-Trent.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

T. W. Jefferson, Ltd.—Mortgage dated June 30th, 1922, to secure all moneys due or to become due from the company to London Joint City and Midland Bank, not exceeding £5,000, charged on 25, Hurst Street, Liverpool. Also particulars of £5,000 debentures authorised June 30th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

Rangoon Electric Tramway & Supply Co., Ltd.—Satisfaction to the extent of £8,985 on April 21st, 1921, and £9,167 on March 31st, 1922, of debenture stock dated February 1st, 1906, December 22nd, 1908, and November 5th, 1913, securing £250,000.

Transit Co., Ltd. (109,799).—Return dated December 31st, 1921 (filed May 12th, 1922). Capital, £5,000 in £1 shares. 4,055 shares taken up. £2,517 10s. paid, being £1 per share on 1,955, and 5s. 10d. per share on 2,100. £50 remains in arrears. Mortgages and charges, nil.

Bath Electric Tramways, Ltd. (74,278).—Return dated May 24th, 1922. Capital, £230,000 in £1 shares (75,000 preference, 125,000 preferred ordinary, and 30,000 deferred ordinary); 75,000 preference, 75,000 preferred ordinary, and 30,000 deferred ordinary shares taken up. £150,000 paid; £30,000 considered as paid. Mortgages and charges, £145,757.

Hardy & Nash, Ltd.—Particulars of £1,200 debentures authorised March 21st, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

Fellows Magneto Co., Ltd.—Particulars of £60,000 debentures authorised June 12th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

CITY NOTES.

General Electric Co., Ltd.

The annual general meeting was held on Tuesday at Magnet House, Kingsway, Mr. H. Hirst presiding. In proposing the adoption of the report (already published in the ELECTRICAL REVIEW) the chairman said he imagined that many of them would be somewhat disappointed at that, the first setback in the results of the company, after its marvellous record during the last fourteen years. For the benefit of those who came with that feeling he read one of the opening sentences of his last year's address, when nearly four months of the present financial year had elapsed:—

> To-day it is my privilege to put before you the balance-sheet of the year just completed, of which we have every reason to be proud, yet the four months of the new year that have just elapsed are casting a shadow over these results. Unrest in the labour world, the stoppage of the coal mines, the shutting down of most of the steel works of the country, the standstill of the shipbuilding industry and automobile industry, the condition of the textile industry, and many more that I could mention have all at once reduced our home market beyond recognition. The general fall in the values of securities has impaired the purchasing power of the public. Simultaneously the state of exchange in many of our foreign markets has interfered with export and has added to the present state of depression, bordering on paralysis.

On that occasion he added the hope that things might improve, but indicated that unless they did the company was temporarily in for a bad time. Things did not improve, and to the long lists of ailments there were to be added a number of additional strikes, the engineering dispute, the state of civil war in Ireland, the state of sedition and civil commotion in India and South Africa, and last, but not least, through various causes a further deterioration of the economic conditions in all European countries, which were already suffering from weak or collapsed exchanges. Bearing in mind these conditions they had done remarkably well—better than they dared to hope—and the results spoke well for the soundness and strength of the company and for the ability of the staff and employés. It was true the results of some electrical concerns published during the last few months might have justified the hope that things were better, but an upheaval such as they had witnessed during the last fifteen months did not affect every company in the same manner. The financial years under consideration did not always cover the same period—a period beginning three or four months earlier or later might make a great difference—and some concerns, particularly those whose work might be called mainly contract work, had the benefit of starting the year with an order book full of unexecuted remunerative contracts accumulated during the end of the war and the period immediately following. Their company happened to be one of different characteristics. They manufactured very largely for stock to fill the shelves of the world with their material, and they suffered naturally from the fact that they produced that stock when wages and raw materials were still high, whilst throughout the year they were selling in a falling market. It was not likely that there would be a further serious drop; stocks had both been replaced at cheaper rates and were reduced. Thus it happened that their sales organisations, which year after year had been the main contributors to their profits, had failed them this year. A carefully built-up organisation could not adapt itself quickly to such extreme changes; its expenses remained substantially the same, but the drop in turnover and falling prices had reduced satisfactory profits in those departments to a minimum. One could not immediately lower wages and reduce staff, and a firm like theirs, which had so many valuable well-trained and loyal old servants, must think twice before parting with any—not only on account of sentiment, but also with an eye to

the turning point, when things got better once more. In addition, he would like to remind the shareholders that year after year they had dwelt—with their approval—on their desire, and on the necessity from the country's point of view, to make themselves a full-gauge electrical concern. They started new departments and works, or extended those in which they seemed deficient or incomplete at great capital expense, and through the conditions which had arisen those new works could not be fully employed at their completion. To have a reduction of net earnings of only about 30 per cent. from their record year in such a year as had just passed was not at all a bad performance; the unpleasant part to them was that it coincided with the year in which they made a debenture issue of some magnitude, and therefore the ordinary shares for a time were rather acutely affected. He had no anxiety for the future of the company, it was as bright as ever. He wished, however, to strike one more warning note that the improvement, which was visible since the termination of the engineering dispute, would have to be continuous and serious if it was to make good the damage which that unfortunate dispute had already caused in the first four months of this financial year. They must, therefore, be prepared for the possibility of another lean year before they got into full swing once more. It had been said "war is the continuance of diplomacy by sword instead of by pen." In the same way one might say "strikes and lock-outs are an attempt to settle negotiations by force whenever peaceful methods have failed." The actual days, weeks, or months of a strike indicated only the actual crisis. Just as a country took years, and sometimes generations, to recover from a war, so the industrial world required months, and sometimes years, to recover from strikes and lock-outs. The country still suffered from the effects of the first coal strike after the war, not to mention last year's hold-up in that important industry. The traces of another strike, not much noted by the public, but very serious for the whole industry of the country, and largely responsible for the suddenness of the industrial collapse which they witnessed at the end of 1920, namely, the moulders' strike of two years ago, were still noticeable, and it might be that the disputes of the last fifteen months might have strained the great resources of the country more than was apparent. They might, therefore, have to wait for another year before they could record a progress over the figures of recent years. In the meanwhile they had to adapt themselves to the conditions which prevailed and mitigate the evil of reduced trade by all further possible economies. Labour and salaries being in their industry the most important item, an adjustment of wages and salaries was the first essential for competitive production. He was afraid wages and salaries would have to be further lowered. It was no pleasure to the employer to reduce wages; it was a great pleasure to every employer to be able to give rises, yet a country that had to live on industry in order to be able to live at all, but which would not take steps to protect that industry efficiently, could not keep in employment millions of workers if it produced at a cost which the world could not afford to pay, or if its prices were above those at which other countries could produce. The papers have been full of late clamouring for the rights of the consumer to buy in the cheapest market. It sounded very well, but had they considered what such a policy meant to the British working man and his family? He doubted whether the saving effected would equalise the additional doles that would have to be paid. Did the public realise that this country paid in sixteen months £85,000,000 in unemployment pay? If the consumer were to pay 10 per cent. more for British-made goods it would require a production of 850 millions on home-produced goods to equalise that expenditure on doles. From those figures they would see it could afford to pay 20—30 per cent. more on home-made goods before the country was any the worse off, because 200 millions of additional business would mean at least 100—120 millions expended in wages (more than the total doles). Good wages under good working conditions improved the race—doles bred degenerates. If labour only understood that it was not the employer, but the foreigner, who fixed his wages, a lot of the conscious and sub-conscious distrust between employer and employed would disappear. When they saw, in spite of the lessons of the war, public bodies, and even Government departments, beginning to place orders with their foreign competitors, when contracts at home and in the oversea dominions were awarded to tenderers from countries with collapsed exchanges, it was high time that both employer and employed should put their heads together to see what cuts must be made in order to enable them to compete, and enforce from the Government such help as it could give to keep industry steady and prosperous, and thus automatically stamp out the evil of unemployment. They had not built the works to see them empty; they wished to fill them, and they could fill them, because they knew the demand was there and, instead of 12,000 workers, they could employ at least 24,000 in due course if they could produce at the right price, and if, at the same time, they could rely on the Empire primarily as their market. It should be no hardship to the worker to accept wages as at present proposed so that they could compete with such industrial countries as America and Switzerland, more especially as great care and expense had been incurred to make the life of their workers in factory and office attractive, healthy and happy; and also, as they were aware, provisions had been made for sickness and old age benefits. All this showed that they had no desire to go back to pre-war conditions, but both employer and employed would have to practise self-denial during the next few years if they were to get the wheels of progress into full swing again. A publication by the so-called Labour Research Bureau had recently been placed in his hands, in which they were taunted with playing into the hands of the capitalist by paying a high price for capital. He did not know the importance of that Research Bureau, but it impressed him with somewhat of an official stamp. If this Research Bureau were to study the problem more thoroughly with a less biased mind it would find that the dearness of capital had been largely the result of the unfortunate attitude of misguided labour during the last few years. There were other conditions prevailing which did harm to industry at the present moment, but which industry alone could not settle unless it had the support of the Government. They could only get that support if employer and employed co-operated; they should insist jointly that public money should only be spent for British labour. They should also insist on better protection against countries with collapsed exchanges. They in this country had tried hard to deflate, and they were proud to-day of the value which the pound sterling had again attained, but no such effort had been made in other countries, enemy or allied. It was not due to political conditions, as was alleged, though political conditions might be contributory. He was convinced those countries thought it good business not to deflate; they preferred to pay the interest on their large internal debts with an inflated currency. He was certain it was easier for them to raise their taxation under deflated conditions; he was certain inflation was an indirect way of cheapening wages. The mark, the krone, the franc, and the lire could drop daily and hourly; wages adjustment in those countries took place quarterly or half-yearly. No sooner did it seem that a settlement was arranged than the exchange went back, all the time at the expense of the British worker. He suffered two-fold: (1) The cheaper labour of the foreign competitor secured contracts which by rights ought to go to Britain; (2) the increased ratio between the value of the currency of their country and ours impaired the purchasing power of their nationals. Our business with them was shrinking. It would thus be seen that both factors contributed towards the unemployment from which they were suffering. It was no satisfaction to them to be told that the internal value of their currency was higher; they were mainly affected by the value of that currency for purposes of export. He enlarged on some of those features because they did not wish to deceive themselves as to the difficulties which they had to overcome before they were in smooth waters again. The world had got to go on, and distinctly saner views were prevailing everywhere, both in foreign nations and at home. Electricity, as he had often before mentioned, would play a leading part in the reconstruction of the world. Many big schemes which had been dangled before their eyes had to be deferred owing to the conditions on which he dwelt. Thanks to the chaos in the building trade the big telephone programme which the Postmaster-General developed before the House of Commons had been delayed for a whole year. When it did come that company was entitled to a fair share of the work which would be offered, both in manual and automatic exchanges. Broadcasting was coming shortly, and would mean a great deal of work for that company for a number of years. Their telephone works were particularly suitable for this class of work. Though they had not as yet appeared in the Press, shareholders and their customers would be glad to know that the company meant to play an important part in the development of broadcasting service and in the manufacture and supply of receiving sets. They had preferred to let the whole scheme mature before they burst out with premature advertisements, but they had designed sets which had been approved by the Postmaster-General, which they had reason to believe were second to none, and they relied on their well-trained sales organisation throughout the country to obtain a considerable share of that business. Orders had been placed with their factories, and they should be ready to supply when the stations were ready to operate. Preliminary arrangements for licences, where required, had been made with the Marconi Co., with which company they proposed to collaborate in giving good broadcasting service. Railway electrification was another development which would help to fill their works. It had been talked of since the early days of the war. It was only just beginning to take practical shape, and they had had their share of what little had been placed so far, and expected to get their full share when the work was being seriously proceeded with. It would lead him too far to go into details as to why it was held up, but it could not be held up much longer. Big power stations would shortly come, and these meant additional work in their industrial department, and when they were started they would give at last the cheap unit of power for which the country had been searching so long, and which, in effect, for many years to come, would be the essential raw material of an industrial country. They had been entrusted with the installation of a 20,000-kW turbo-alternator for the Birmingham Corporation, which he believed would be the standard size of plant for these power

stations in the future. When the cheap unit of energy did come it would create a demand for their staple business, *viz.*, industrial and domestic appliances, in such quantities that would stretch the manufacturing resources of this country. But all this development could not come overnight—they might have to go through lean times before they were in sight of that Eldorado, the electric age, of which so much has been said and written, and the arrival of which had been largely delayed through a small body of firebrands who had set the whole country by the ears, and, for reasons which were now apparent to everybody, had caused distress and misery where plenty and happiness might reign. They were in no way disheartened, they were as enthusiastic as ever as to their future. They had used the quiet period of the last twelve months on the one hand to simplify their organisation, and on the other hand to effect economies wherever possible, but they had at the same time expended time and money in research and development in every branch of the electrical engineering industry, and they would be ready for their task and rise to their responsibility and expectations whenever the signal to march forward was sounded.

Mr. E. G. Byng seconded the motion, which was carried unanimously.

Brazilian Traction, Light & Power Co.

The revenue for 1921 amounted to $4,410,057 (against $7,036,824), and interest on investments, &c., amounted to $127,657 (against $206,619). General administration expenses, interest, &c., amounted to $1,000,033 (against $988,320), and $300,000 (against $260,000) is provided for general amortisation, leaving a net revenue of $3,237,681 (against $5,995,123). After deducting the preference dividend and adding $3,082,132 brought forward there remains a balance of $5,719,813 to be carried forward. It is stated that the claims against the Federal Government for exchange differences during the last three years are still unsettled. The directors feel justified in resuming the payment of ordinary dividends, and have declared a dividend of 1 per cent., payable on September 1st.—*The Times.*

United Electric Tramways of Montevideo, Ltd.

Sir George A. Touche, Bart., presided at the annual meeting held on July 14th. In presenting the report, which was abstracted in our last week's issue, he pointed out that the gross receipts of £555,725 constituted a record. Against this, however, operating expenses had shown a greater increase, proving that, while the company's facilities were increasing, no benefit was being received. As mentioned in the report, there was an urgent need for revision of tariffs. It was fundamental that a company which served the public had a right to public protection and fair compensation. A Bill authorising an increase in the 4 cent fare to 5 cents, but disallowing an increase in the price of monthly tickets, had been passed by the Uruguayan Lower Chamber, but was held up in the Senate pending a general election in November next. This Bill also introduced a variety of conditions, one of which was that any surplus over a certain dividend on the ordinary shares should be divided with the municipality. The speaker referred at length to the seizure of the company's system by the municipality, which has received previous mention in our pages. No ultimate remedy obtained by legal process could counteract the effect upon authority and discipline of this unjudicial interference between employers and employed. The action of the municipality had received general disapproval in Uruguay. Turning to the economic situation in the country, the chairman said that Uruguay, like many other countries, was passing through a difficult period. Expenditure had increased; trade was stagnant; reserves had fallen; and the fiscal year closed with a heavy deficit. In conclusion, Sir George paid a tribute to Señor Cat, who had carried out his duties faithfully during a very trying period.

Chile Telephone Co., Ltd.

The report to March, 1922, shows that the subscribers at all centres aggregated 20,104, an increase of 237 for the year. The gross revenue from all sources was £167,911 and the gross expenditure £121,895, leaving £46,016 profit, plus £16,505 brought forward, making £62,521 available. A final dividend of 3s. per share, free of tax, makes 6 per cent. for the year; £24,547 is put to general reserve; £5,000 to reserve for renewal of plant; £3,274 carried forward. The depression in the general commercial situation in Chile has continued, owing mainly to the paralysis of the nitrate industry. The average rate of exchange during the year was 6¼d., as compared with 10¾d. during the preceding year.

Marconi International Marine Communication Co., Ltd.

The gross revenue for the year ended December 31st, 1921, amounted to £1,084,460, as compared with £933,568 in preceding year. The net profit of £118,043, however, shows but a small increase as compared with £117,570 in 1920. This is mainly due to the year's having been one of great depression in the shipping trade, necessitating the laying up of a large number of ships. The directors thought it proper to meet the wishes of shipowners during the time that ships were laid up and the consequent rebates of rentals and payments to operators whilst unemployed amounted to approximately £100,000, affecting the year's profits to this extent. The exceptional conditions prevailing were responsible for a number of shipping companies going into liquidation. £12,000 is written off in respect of bad and doubtful debts. In the circumstances, notwithstanding the fact that the company's business has continued to increase, the profits for the year have been sensibly reduced. The directors recommend a final dividend at the rate of 5 per cent., which, together with the interim dividend, will amount to 10 per cent. for the year. Some improvement has taken place in the shipping trade this year, and the number of ships laid up has been reduced by approximately one-half. Meeting: July 25th.

Manila Electric Corporation.

The name of this company was until December last the Manila Electric Railroad and Lighting Corporation. The gross revenues for 1921 were $3,681,398, an increase of $262,991, or 7.69 per cent. Net revenue, $1,450,058, an increase of $221,484, or 18.12 per cent. Four quarterly dividends of $1.50 per share were paid, leaving $646,231, which was transferred to surplus, making the total accumulated surplus, including reserves, $3,673,054, an increase of $658,658. Business conditions in the Philippine Islands suffered a severe depression during the year, but in spite of this the gross operating revenues of the company were greater than in any previous year. It is believed that the worst of the depression is over and that conditions will gradually become normal. The company supplies the entire electric light, power, and street railway service in the city of Manila (the capital of the Philippine Islands) and its environs, serving in all a population in excess of 350,000. The properties operated comprise some 55 miles of railways, and power stations, supplying light and power for Government, municipal, and private use. An issue of $2,500,000 first refunding mortgage 7 per cent. gold bonds due 1942 was made in April, 1922, to provide funds for the redemption of the three-year 7 per cent. notes due September of this year, and for extensive additions to the generating plant, now nearly completed, and other corporate purposes.

Prospectus.—*The Bengal Telephone Corporation, Ltd.*—The list was to close "on or before" to-day, in an offer for sale by the P. and O. Banking Corporation, Ltd., of £350,000 7 per cent. first mortgage bonds to bearer at 97 per cent. The issue is made to provide funds for capital outlays already made for the development of the business and for further extensions and improvements, and for carrying into effect the requirements of a new agreement with the Government of India.

The list was closed early on Tuesday morning, but country applications were to be considered if received by first post on Wednesday.

Capital Issues in Germany.—Although there has been a very perceptible decline in the capital increases in general in Germany during the past two months, the totals for the first half of 1922 still represent considerable sums in paper marks. The emissions of new shares in the case of existing electricity and gas works, which totalled 1,995 millions of marks in 1921, amounted to 1,402 millions in the first quarter in 1922, and to 398 millions in the second quarter. In addition new companies in these two branches raised 1,709 millions in 1921, as compared with 82 millions in the March quarter of the present year, and 209 millions in the second quarter.

Anglo-Argentine Tramways Co., Ltd.—The results of the working for the first half of the year 1922 will permit of the payment of a half-year's dividend on the 5½ per cent. cumulative second preference shares. This will satisfy the arrears to June 30th, 1918.

Dublin United Tramways Co., Ltd.—Dividend at the rate of 6 per cent. per annum, less tax, on the preference, and an interim dividend at the rate of 3 per cent., per annum, less tax, on the ordinary shares, for the half-year ended June 30th.

W. & T. Avery, Ltd.—Further dividend of 10 per cent., less tax, on the ordinary shares, making 15 per cent., less tax, for the year. £10,000 to reserve; £36,163 carried forward.

Edison Swan Electric Co., Ltd.—The dividend on the first preference shares for the period to July 31st, 1922, will not be paid. The preference dividend for the half-year ended January, 1922, was also unpaid.

Electrical Distribution Co. of Yorkshire, Ltd.—Interim dividend of 7 per cent. per annum, free of tax, on the ordinary shares.

Kaministiquia Power Co.—Dividend of $2 per share, at the rate of 8 per cent. per annum, on the common stock, for the quarter ending July 31st.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—Interim dividend of 5 per cent. on the ordinary shares for the half-year ended June 30th last.

Clontarf and Hill of Howth Tramways Co., Ltd.—Interim dividend, 3 per cent. per annum.

Mather & Platt, Ltd.—Interim dividend of 3 per cent. actual, tax free.

Yorkshire Electric Power Co.—Interim dividend of 3 per cent., less tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

THE expected reduction in the Bank Rate to 3 per cent., which took place yesterday week, failed to stimulate business to any material extent in the Stock Exchange markets, although, of course, it is another step in the right direction, emphasising the cheapness of money and the folly of accepting the nominal rate of one per cent. which bankers now allow on deposit money. The immediate result has been a stiffening of prices amongst purely investment stocks. It becomes again a matter of increasing difficulty to obtain sound securities at anything like the issue prices. Several big companies contemplate the issue of more stock in the early future. It may be that this week will see underwriting arrangements in progress for a substantial amount of new stock to be offered by one of the London Electricity Supply companies. The 4½ per cent. debentures lately offered by the London Electric and the City & South London companies have already become so well placed that it is difficult to buy the former company's stock, while the prices of both have risen to 1½ premium. The recent offers of Indian Electric debentures continue to lag behind the general improvement that is noticeable amongst most securities of their class. The Calcutta Electric second debenture maintains its premium of 2½, but the Indian fives and Madras sevens stand at 94 ("par") and 95¼ (¼ premium) respectively.

An offer by the P. & O. Banking Corporation of £350,000 seven per cent. first mortgage debenture bonds of the Bengal Telephone Corporation, at 97, was promptly snapped up by the public. The subscription lists closed soon after they were opened.

Electricity Supply shares are generally strong. Investors are quick to notice the Clause passed last week by the Electricity Supply Bill Committee, which gives the Electricity Commissioners power to extend the tenure of the companies to any period they see fit, provided the local authority concurs. As is well known, most of the companies are working under the 1882 Act, and although this has been modified out of knowledge, to the advantage of the companies, there remains even to this present day a lurking, if superstitious, apprehension of the companies being treated with the generosity usual in such circumstances as those where legal authorities are able to exercise any power of control. Charing Cross ordinary shares have risen to 7¼, and the remainder of the share list shows no alteration, although the difficulty of acquiring good stock is as apparent as ever. Smithfield ordinary shares stand at 3¼ and the 4 per cent. debenture stock at 70.

In the Provincial list, Oxford ordinary have risen to 3⅞ and the preference to 3¼. With regard to the former, it is worth noticing that the last time the shares changed hands in the Stock Exchange was at 50s. 7½d., some nine months ago. Newcastle-on-Tyne ordinary stand at 14s. for the old and new alike. The 5 per cent. non-cumulative preference are 15s., and the 7 per cent. cumulative preference 21s. 6d. The 6 per cent. second mortgage debenture stock changed hands this week at 102¾. Urban ordinary at 10s., and the preference at 44s., are marking time.

Victoria Falls ordinary keep good at 14s., and the first preference are an active market at 22s. 6d., the present animation in South Africans drawing people's attention to these shares. South Wales Electric Power Distribution ordinary have been done at 5s. within the last few days, and the 5 per cent. debenture stock came in about 55¼, at the end of last week. A quiet business continues to be done in North Metropolitan Electric 8 per cent. second preference stock on the basis of 102½-103. Midland Counties ordinary shares are 12s. 6d. The 7½ per cent. mortgage debenture stock remains firm at 106. Electric Supply ordinary shares are being dealt in around 35s. Clyde Valley Electric Power 8 per cent. second preferences remain close to £12.

The report of the Marconi International Marine Communication Co. shows that although the company's business is progressive, the expenditure tends to keep pace with the income. For the year ended last December, the gross revenue was just over a million pounds sterling, and the net profits came to £118,000, some three or four hundred pounds higher than those of the year before. The directors have decided to adopt a conservative dividend policy, owing to the depression in the shipping trade and the consequent laying-up of ships; therefore the shareholders will receive 10 per cent. for the year, as against 15 per cent. for 1920, and £25,000 goes forward. The effect upon the price was to cause it to drop about a florin to 1 5/16, and the parent shares, which from 2¼ had risen to 2 5/16, reacted to 2 3/16. It is generally expected that, unless the Marconi Co. can show some substantial payment from the Government in the accounts to be presented at the end of this month, the dividend in this case also will be reduced from 15 per cent. to 10 per cent. No doubt a reduction is considerably discounted, but in the circumstances it is not surprising that holders should feel a little nervous.

The Eastern Cable group remains good, and part of the dividends deducted last week have already been recovered by Eastern Telegraph ordinary stock and Eastern Extension shares. Globe ordinary rose to 19½, the preference to 11½, Westerns to 18¾. In this, the jubilee month of the Eastern Telegraph Co., it is interesting to notice that the price of the ordinary stock at 186½ stands at very nearly the highest point reached in its history, because, although the quotation went over 200 when the last bonus distribution was made (by the issue of stock at 100 to the proprietors), the present quotation is, of course, for the extra capital. Chili Telephones at 6 3/16 are ¼ down. Indo-Europeans fell a point to 36½. The manufacturing group is firm, Telegraph Constructions recovering the dividend of 5s. net deducted a week ago. Crompton ordinary at 15s. are also ex the dividend of 1s., and show no change in the price. General Electrics are quieter, the price of the ordinary being unchanged at 18s. 3d. English Electrics retained their rise on the recent success of the company in securing the contract for 34 electric locomotives ordered by the Japanese Government.

Anglo-Argentine Trams second preference are 2s. 6d. up, on the dividend announcement; the company goes steadily ahead with the payment of arrears on the shares. Brazilian Tractions weakened in sympathy with the Government bonds' decline. A rise of 5 points lifted Mexico Tramways seconds to 42½. Electric Railway stocks are somewhat irregular. Underground incomes subsided to 79½, but the £10 shares are a good market at 2⅞. The Stock Exchange is asking when it may expect some kind of reorganisation of capital scheme that may, conceivably, be of decided benefit to the £10 shares. London General Omnibus first debenture is better at 89, and the income debenture hardened to 86.

Armament shares are quiet, with a dullish disposition, and the rubber market remains comatose.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price July 18, 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	7¾	+ ¼	6 4 2
do. do. do. 4½ Pref.	4½	4½	3⅝	—	5 16 2
Chelsea	6	6	5¾	+ ¼	5 4 4
City of London	14	14	2	—	7 0 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1⅞	—	6 2 0
do. do. 6 per cent. Pref.	6	6	1⅞	—	5 13 0
Kensington Ordinary	9	10	7½	—	7 0 7
London Electric	3½	4	2⅝	—	5 14 0
do. do. 6 per cent. Pref.	6	6	6	—	6 0 0
Metropolitan	7	7	5⅜	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3¼	—	5 16 2
St. James' and Pall Mall	12	12	8½	—	6 17 2
South London	7	7	5¾	—	8 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 18 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref	6	6	104xd	+1	5 15 5
do. Def.	1½	34/6	23⅜	—	7 7 6
Chile Telephone	6	6	6⅛	— ⅛	4 17 0
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	184xd	+ ½	5 8 1
Eastern Tel. Ord.	10	10	186¾xd	+1½	5 7 3
Globe Tel. and T. Ord.	10	10	19⅜	+ ⅛	5 4 7
do. do. Pref.	6	6	11½	+ ½	5 6 8
Great Northern Tel.	24	22	28⅝	+ ¼	7 16 3
Indo-European	10	10	36½	—1	6 17 0
Marconi	25	15	2⅞	— 1/16	6 17 0
Oriental Telephone Ord.	12	12	23⅝	—	*5 1 1
United R. Plate Tel.	8	8	7½	—	*5 12 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅞	+ ¼	*5 6 8
HOME RAILS.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	48	— ½	4 13 9
do District	Nil	1	20	+1	2 11 3
Underground Electric Ordinary	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	2	4	70½	—2	*5 0 8
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	9⅞	—	7 17 2
do. do. 2nd Pref.	Nil	5½	3⅞	+ ⅛	7 2 0
do. do. 5 per cent. Deb.	5	5	81½	—	6 4 3
Brazil Tractions	Nil	Nil	61	—1	7 16 10
British Columbia Elec. Rly. Pcc.	5	5	80½xd	+2	6 4 3
do. do. Preferred	5	20/-	69½	—	*6 18 0
do. do. Deferred	3	12½/-	75½	+1	*8 4 6
do. do. Deb.	4½	4½	78	—1	5 9 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	11½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	42½	+5	Nil
Mexican Light Common	Nil	Nil	22⅜	—	Nil
do. Pref.	Nil	Nil	52	—	Nil
do. 1st Bonds	Nil	5	68½	—	7 6 0
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	9	—	5 6 8
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	24	—	7 1 2
Callenders	15	15	21½	—	7 5 3
,, 6½ Pref.	6½	6½	1⅞	—	6 9 6
Crompton Ord.	10	5	15/-xd	+9d.	6 13 4
Edison-Swan	10	Nil	4/6	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	12	—	8 0 0
English Electric	8	5	17/6	—	5 14 3
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/3	—	5 9 7
Henley	15	15	23	—	6 13 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	2½	—	—
Met.-Vickers Pref.	8	8	2⅞	—	6 11 2
Siemens Ord.	10	10	1⅞	—	*7 19 4
Telegraph Con.	20	20	26xd	+ ½	*4 12 2

* Dividends paid free of Income Tax.

AN ALL-ELECTRIC KITCHEN.

The Witton G.E.C. Club Installation.

In connection with the visit of inspection paid to the Witton engineering works of the General Electric Co., Ltd., at Birmingham, during the recent I.M.E.A. Convention, the following descriptive account and illustrations relative to the electric cooking installation in the "Magnet" Club, which is attached to the Witton works, and is used for the benefit of the employés there, should be of interest. Incidentally, it may be mentioned that the fine club-house was erected by the company in memory of the many who went from Witton to the Front and who did not return.

The club possesses an up-to-date electric kitchen, the whole of the equipment for which was manufactured at the company's heating and cooking works at Birmingham. The kitchen was planned for the supply of meals to the staff and employés, approximating 2,000, and has been in operation for over 18 months, with complete success.

The main equipment comprises four ranges, each fitted with three ovens, grillers, steaming ovens, vegetable boilers, fish fryers, stock pots, hot cupboards, saucepans and boilers, together with the necessary control gear.

Fig. 1.—General View of the Kitchen.

Fig. 2.—The Electric Ovens.

When considering the planning of the kitchen, it had to be borne in mind that, whilst large numbers had to be catered for, there was no need to make provision for great variety in the type of meal. Any portion of the plant for cooking in any particular way had to be capable of providing for the full number of diners at any one time.

In the design of the whole of the appliances the guiding principle adopted was simplicity of construction, so that access could be easily obtained to any particular part. In the ovens the whole of the electrical portion can be readily removed, leaving an entirely free space for cleaning. There are no crevices for fat or dirt to accumulate in, and all seams are welded.

With the exception of the stock pots, all appliances have

Fig. 3.—A Group of Electric Boilers.

self-contained elements, whilst the problem of vegetable boiling has been successfully solved by providing such loading that an ample reserve of heat is available to raise the temperature quickly to the boiling point.

The following details of the equipment are of interest:—

Ovens.—Four ranges are provided, each fitted with three ovens of 8 cu. ft. capacity, wired for 5 kW maximum consumption, with low heats of 2½ kW and 1¼ kW. They are operated by series parallel switches, and the elements are of the Firenza type. On two of the ranges plug receptacles are provided for separately heated utensils.

The *Grillers* are arranged with hot-cupboards above and below, the upper ones receiving the heat from the actual grilling elements. Each half of the griller is wired to consume 8 kW, and sub-divided again, so that only a quarter of the total grilling area need be in use if so desired.

Steaming Ovens.—These are double-cased and lagged, and the doors are arranged with steam-tight joints. A constant water-level attachment is fitted to avoid the possibility of boiling dry. Current consumption is 5 kW maximum, with low heats of 2½ and 1¼ kW. They are operated by series parallel switches.

The *Vegetable Boilers* are each of 30 gallons capacity, made in heavy copper, double cased, and arranged with series parallel switches. Current consumption is 6 kW, 3 kW, and 1½ kW. They are fitted internally with the usual wire baskets and strainers, &c.

The *Fish Fryers* are welded steel pans 36 in. x 18 in. x 8 in., the current consumption to each section being 6 kW, with low heats of 3 kW and 1½ kW.

Stock-Pots and Stand.—The stock-pots are made of heavy copper, and the heating elements are not self-contained, but the stand is provided with a hot-plate 20 in. square loaded

to 50 kW maximum, with low heats of 2¼ kW and 1¼ kW, and series-parallel operation is provided for.

Hot-cupboards and Carving Tables.—These are each provided with three carving wells, separately heated, the consumption for each being 500 watts. The hotcupboards have a maximum consumption of 3 kW; over-head control is fitted.

Saucepans and Boilers.—These are all fitted with self-contained heating elements, with series parallel control. Pilot lamps are fitted near the plug receptacles, to which they are connected.

Fig. 4.—An Electric Oven and Grill.

Control Gear.—The series-parallel principle has been adopted throughout the whole of the cooking apparatus in the canteen, and pilot lamps are fitted in every circuit. The internal connections in the apparatus are almost entirely of stiff strip metal, and the use of beads is almost eliminated. Mica insulation is adopted throughout, except where red-hot coils are used.

The whole of the apparatus has been wired for use on a 220-volt 3-wire system, the various items being arranged so that they can easily be balanced.

LIGHTING IN FACTORIES AND WORKSHOPS.

H.O. Departmental Committee's Third Report.

The third report of the Home Office Departmental Committee on the above subject,* which has just appeared, contains some useful information on industrial lighting. The first portion is devoted to a summary of previous recommendations, which appeared in the first interim report (1915) and the second interim report (1921). The contents of these have already been noted in our pages, but it may be useful to recall some of the chief conclusions.

The chief recommendation was that there should be a statutory provision "(*a*) requiring adequate and suitable lighting in general terms in every part of a factory and workshop, and (*b*) giving power to the Secretary of State to make Orders defining adequate and suitable lighting for any part thereof or for any processes carried on therein." The Committee also stated the illumination necessary in the interests of convenience and safety, *e.g.*, a minimum of 0.25 foot-candle over the "working area," 0.4 ft.-c. in foundries, and 0.1 ft.-c. in parts where people are liable to pass, but work is not done. These values were given irrespective of the illumination necessary for the actual carrying on of work. The second report dealt in general terms with the avoidance of glare, inconvenient shadows, and flicker. Avoidance of glare was covered by a special clause, limiting the position of bright sources with respect to the eye.

There remains the problem of specifying the degree of illumination necessary for the carrying on of various industrial processes, and this is dealt with in the report now issued. Two alternative courses suggest themselves:—

(1) Definite minima may be laid down, below which illumination on any part of the working plane must not fall, and (2) standards of illumination may be specified as recommended practice, to serve as guides in determining whether lighting is adequate.

Such standards would not be legal minima, but would conform to the best modern practice and would represent figures which may reasonably be expected for the general standard of illumination over the working plane.

The Committee, after visiting various factories where measurements of illumination were made, and reviewing data available on codes in use in other countries, has decided on the second course. In an appendix a great variety of processes is classified as "fine work" requiring 3 foot-candles, and "very fine work" requiring 5 foot-candles. It considers that extensive investigations are needed before definite minima to be enforced by legislation can be recommended.

As a preliminary to more detailed procedure, and in order to avoid hardship to employers and much administrative difficulty, a careful and systematic inquiry is needed on the following lines:—(1) The collection for every process concerned of a sufficient number of observations to give some indication of the best existing practice; and (2) experimental research with the object of discovering the conditions of illumination desirable on physiological and psychological grounds.

Ample proof is now forthcoming of the relation between lighting and production and safety, and it seems reasonable to expect the co-operation of all the chief industries in which lighting is specially important. It is therefore suggested that these industries should assume partial responsibility for the scheme of investigation by collecting data—possibly through the research associations where they exist.

Various other experiments are described in the report, notably an inquiry into the debateable question of the effect of a mixture of natural and artificial lighting. While this was somewhat inconclusive in the main object aimed at, it led to some interesting results. Workers, for instance, asserted that in full artificial light "the surrounding darkness acted like a nagging foreman," with the result that for the short period of the test output was increased far beyond what could have been maintained for any length of time. But the conditions in these circumstances were very fatiguing, and quite different from those experienced with semi-indirect lighting. This experience seems to confirm the view, expressed elsewhere in the report, that an excessive contrast between the brightness of illumination on the work and the surrounding area is objectionable.

Attention is also drawn to the well-marked relation between accidents and inadequate illumination. It is gratifying to note that the standard of industrial lighting has improved greatly during recent years.

The appendices to the report also contain a summary of the requirements, as regards amount of illumination, of the various American codes on industrial lighting.

*H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1. Price 9d. net.

ELECTRICITY IN FACTORIES.

H.M. Electrical Inspector's Report.

The annual report of H.M. Chief Inspector of Factories and Workshops for 1921 was issued on July 8th*, and with it an abridged form (official edition, form 954A) of the regulations made by the Secretary of State for the generation, transformation, distribution, and use of electricity in premises under the Factory and Workshop Acts, 1901 to 1920.

In the chapter on the generation and use of electricity Mr. G. Scott Ram, M.I.E.E., senior electrical inspector of factories, reports that the most notable incident in his section during the year has been the appointment of four additional electrical inspectors. The need for an addition to the staff has long been felt, and was recognised by the authorities as far back as 1914, in which year four such appointments from amongst inspectors already on the staff had actually been arranged, when the war intervened and prevented the scheme from being carried out. The present appointments have been made from outside the staff, as it was felt that only men who had been properly trained as electrical engineers and whose subsequent experience has been entirely in electrical engineering should be appointed. Hitherto, even with such help of the district staff as has been available, not only has it been impossible to investigate many of the accidents, but the amount of inspection of electrical stations and plant on factory premises has been very inadequate when it is considered that there are over 600 electricity supply undertakings, having generating stations and several thousand sub-statoins, and about 70,000 works wherein electricity is used for driving machinery and other purposes.

Reports from the district staff covering the past year confirm of Mr. Ram's own observations that in general the quality

*H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1. Cmd. 1705; price 3s. net.

of new work on factory premises continues to improve, but there are exceptions, generally where the occupier, not having technical knowledge, relies entirely on a contractor, who secures the order on the question of price only. The contractor sometimes being incompetent or unscrupulous, an inferior and often dangerous job results.

Electrical manufacturers have done much to improve apparatus and accessories from the safety point of view.

The number of accidents due to electricity reported during the year was 322, of which 12 were fatal—a reduction of 81, or 20 per cent. on the total and 50 per cent. on the fatal cases compared with each of the two preceding years. The reduction in the total is no doubt partly due to a higher standard of electrical work generally, but it may be to some extent influenced by slackness in trade, many works having for part of the period been partially shut down. The reduction in the relative proportion of fatal cases is also satisfactory, but cannot, Mr. Ram fears, be regarded as a premanent improvement, so much depending upon the chance circumstances of the accidents. The reduction in the fatalities is entirely in respect of the low-pressure shock cases, there being only five, as against 19 and 20 in the two preceding years. Incidental circumstances, such as the duration of the contact measured in seconds, the naure of the floor on which the victim happens to be standing at the moment, and whether there is efficient first-aid promptly at hand, have an important influence in determining whether such accidents have merely slight or fatal results.

Twenty-one of the accidents occurred on high-pressure or extra-high-pressure systems, seven being fatal. Seventeen of them, including five of the fatal cases, occurred in public supply stations, eight of them (two fatal) were to skilled persons, and nine (five fatal) to unskilled persons. Four of those to skilled persons were due to foolhardiness, and five occurred to unskilled persons who were set or permitted to work under similar circumstances. The employment of labourers or other unskilled persons in dangerous work in such stations and without proper supervision is still far too prevalent.

The other four accidents to skilled and two of those to unskilled persons were due to those in charge of the work erroneously supposing that the conductors had been isolated and made dead. In this class of accident, many of which have occurred in previous years, the result when not fatal is often serious permanent injury, and any additional means of prevention is to be welcomed. An actual test by a suitable instrument to prove that the conductors have been isolated and made dead before the work is commenced is obviously the safest course. In some works, where the pressure is high enough, a rough and ready test is made by means of the insulating rod provided for operating the isolating switches, the metal hook at the end of the rod being held close to the conductors which, if live, will show a spark discharge. It is much better, however, to provide a special instrument for the purpose. Such an instrument, consisting of a vacuum tube on the end of an insulating rod, has been in use for many years in a few cases. The vacuum tube will glow if the conductors are live. In case the tube should be out of order, it is first tried on a conductor known to be live. Another instrument, specially designed for the purpose, is now available and indicates by a spark discharge. This instrument has been designed by the engineer of one of the large electricity supply companies and has already been in use in the stations of that undertaking long enough to prove its usefulness, more than one serious accident having been known to have been prevented. It has been readily taken up by other undertakings where Mr. Ram has drawn attention to it, and it only needs to be more widely known to be more generally adopted. Its range of use, as at present available, is for systems between 3,000 and 11,000 volts, and an instrument suitable for still higher pressures is being experimented with.

Of the low-pressure and medium-pressure accidents, a large proportion (70) was, as usual, due to persons, both skilled and unskilled, cleaning or repairing live switchboards or other apparatus. Portable apparatus and connectors accounted for 57, and a number again occurred in the renewing of fuses not constructed or protected as required by the regulations. The circumstances and causes of these accidents were in general similar to others described in detail in previous reports. Attention may be usefully drawn to a fatal case involving an increasingly widespread risk, regarding which a warning was issued in the 1916 edition of the published memorandum. This concerns the use of the screw-socket type of lampholder. When used, as was always the case up to a few years ago, with lamps fitted with screw caps which entirely entered the screw socket, there was no objection. Recently, however, lamps, both of small and large sizes, are made with a metal extension of the screw cap in the form of a cup covering the neck of the lamp and extending far outside the screw socket of the holder. It is invariably overlooked that this exposed extension of the screw cap is in electrical connection with the circuit and is live and may be dangerous to touch. In the case in question a man was attempting to remove a lamp from the holder and took hold of the metal cup and was killed. This accident occurred on the premises of an important electrical power supply undertaking, where one might expect that the wiring would have been correctly carried out. The single-pole switch controlling the circuit was, however, connected in the earthed neutral lead instead of in the phase wire of the circuit, so that even had the switch been turned off it would not have prevented the accident. It appears that for lamps of small size there is no need whatever for this cup extension of the screw cap, but for large size lamps it is necessary for the secure attachment of the lamp. The use of the metal extension is not in accordance with the regulations unless the lamp is used with a holder or fitting which will entirely screen the live cap so that it cannot be touched whilst in contact with the circuit. Lampholders for use with these lamps should be provided with a petticoat extension of insulating material to shield the live metal, or preferably any necessary extension of the screw cap should be made of a suitable insulating material.

In June a pamphlet on electric arc welding,* dealing with the precautions necessary in respect of dangers met with in the process, was issued by the Department, and has proved very useful.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Homelite" Lighting Plant.

Fig. 1 illustrates a small lighting plant of novel design, which is being sold by the Sun Electrical Co., Ltd., 118 & 120, Charing Cross Road, W.C.2.

The set, which weighs only 100 lb., has a height of 18½ in., a length of 20 in., and a width of 13 in. As seen in the illustration, it is mounted on springs. The engine is a single-

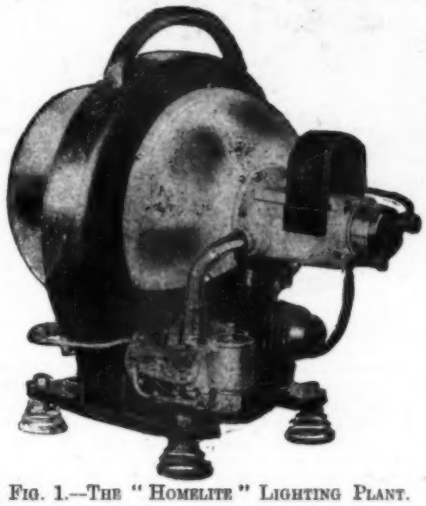


Fig. 1.—The "Homelite" Lighting Plant.

cylinder, two-stroke, air-cooled petrol motor running at a speed of 1,450 r.p.m. It is direct-coupled to a six-pole shunt-wound dynamo giving an output of 400/450 W at 32 V. Ignition is provided by a Simms h.p. magneto mounted on the main shaft. Batteries of 16 cells, capable of outputs of 50 Ah or 75 Ah are provided with the "Homelite" set.

"Ballsok" Insulating Beads.

Messrs. Lionel Robinson & Co., 3, Staple Inn, W.C.1, have sent us a sample of insulating beads which would appear to be of great value to manufacturers of electric heating and cooking appliances. It is customary to cover the wires which

Fig. 2.—"Ballsok" Insulating Beads.

connect the elements of such appliances to the controlling switches with glass beads, which, while satisfactory at the lower temperatures, always leave parts of the wire, at bends, exposed, and at high temperatures are unable to "stand up" to the conditions.

* Memorandum on Electric Arc Welding, Form 329, price 3d., obtainable from H.M. Stationery Office, and usual agents.

The present invention employs a material which, while perfectly non-hygroscopic, is capable of being used in very high temperatures. By a special method of moulding, the beads form a ball and socket arrangement (hence their name—"Ballsok"), ensuring the complete protection of the wire to which they are applied. The arrangement is shown in fig. 2. The makers (who are English) claim that the beads are moulded to within .001 in. of the correct size.

The Runbaken "Ford" Commutator.

The out-of-date design of commutator forming part of the "Ford" car ignition system, is short-lived, and a constant source of trouble owing to the fact that the current has to pass through an oily roller and bearing pins causing sparking and pitting. To remedy this the Runbaken Magneto Co., Ltd., Cheetwood Road, Derby Street, Manchester, has put a new form of commutator, fig. 3, on the market for incorporation in the existing "Ford" ignition system. The commutator consists of eight copper sections, four "live" and four "dead," insulated from one another by thin walls of "Stabilite" which is said to wear at the same rate as

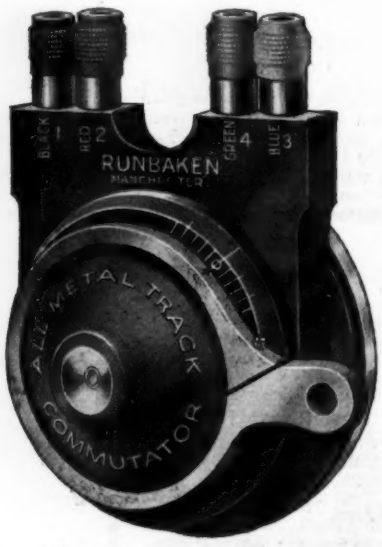


Fig. 3.—The Runbaken "Ford" Commutator.

Fig. 4.—The "Sentry Ketteljack."

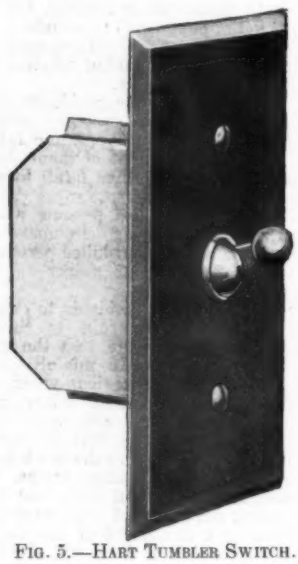


Fig. 5.—Hart Tumbler Switch.

copper. The segments are moulded in the insulation under hydraulic pressure. The rotor sleeve carries a sprung arm holding a small copper-wire brush. The terminals are fitted at the top of the casing, where they are clear of the oil and belt. These terminals are of the split pin type, fitting into brass sockets which are moulded into the insulation. They are distinctively coloured and numbered to prevent mistakes in connection. The timing arm has a large range of adjustment, ensuring greater accuracy than usual.

The "Maco" Adjustable Template.

We have received from Mr. E. James Brown, 12, Montserrat Road, Putney, S.W.15, a simple device for securing the profile or shape of articles with little or no trouble. This is the "Maco" template illustrated in fig. 6. It consists of hundreds of steel or brass strips, .007 in. thick, held in position between

Fig. 6.—The "Maco" Adjustable Template.

two clamps, in an aluminium frame, which are tightened up by means of milled thumb-screws and springs. In use, the screws are loosened and the edges of the strips are pressed against the profile required. The strips then move to take up the outline and, in addition to this, their opposite ends give a similar "solid" outline. The thumb-screws are then tightened and the template is ready for use.

It will be seen that an enormous amount of labour and expense can be avoided by the use of this device; in fact, it is one of those things that "should have been thought of before."

The Hart Tumbler Switch.

A new tumbler switch has just been placed on the market by the Hart Manufacturing Co., of 76, Rochester Row, London, S.W.1, which differs entirely from any other tumbler switch in existence, the mechanism being similar to that employed in the same company's well-known push-button switch. As shown in fig. 5, it is of the flush type, and makes a very neat job. The action is positive, giving a rapid make and break; the contacts are of phosphor bronze, and all wearing parts of case-hardened steel, and the mechanism is very efficiently insulated from the parts that carry current.

These switches are being manufactured in single-pole, d.p., 2-way, and 4-way patterns.

Kettle Suspender for Electric Fires.

Messrs. Wood, Russell & Co., 34 and 36, Oxford Street, W.1, have produced a simple but useful device, specially designed for use with electric fires. This is a jack for holding a kettle over a fire or boiling ring, fitted with a pot-hook and adjustable links. The "Sentry Ketteljack," as it is called, is illustrated in fig. 4.

Auroral Phenomena.—Mr. A. Gibbs, M.I.E.E., deputy chief telegraph engineer of the Dominion of New Zealand, writes to the *Post Office Electrical Engineers' Journal* on the telegraph, telephone, and wireless interferences experienced during an exceptionally brilliant display in May last year, and states that they were of greater magnitude and more far-reaching in their effects than any of which the New Zealand Telegraph Department has record. It is the first time, also, that the effect of the aurora upon wireless communication in this, or probably any other country, has been so noticeable.

An interesting experiment was performed at Awarua, where during the height of the disturbance an insulated counterpoise (or network of insulated wires) was substituted for the usual earth connection. In effect the wireless receiving system was entirely disconnected from the earth, and therefore not subject to direct interference from electrical charges circulating therein. This removal of the earth connection did not in any way affect the prevailing variations of the signals, which continued to be as erratic as ever. During the period referred to there were brief intervals at all New Zealand stations when signals returned to normal and nothing unusual was noticed. The effects at New Zealand stations may be summarised as follows: (1) Great and sudden variations in signal-strength from maximum to minimum; (2) signals from different directions not simultaneously affected; (3) dead periods when neither signals nor statics were heard; (4) period of abnormal intensity of signals and statics; (5) signals from European long-wave stations unaffected during the whole period. All of the New Zealand stations are connected by land telegraph lines with the telegraph centres, and it was noticed at times that great variations in radio signals were simultaneously accompanied by earth currents in the land telegraph lines of sufficient intensity to render the Morse circuits inoperative.

THE NEW QUEENSTON-CHIPPAWA GENERATORS.

The rapid advance which Canada has made in the field of electricity-generating by water power is exemplified by the huge sets recently put into commission at the Queenston station of the Hydro-Electric Power Commission of Ontario. These 45,000-kVA sets have been built by both the Canadian General Electric Co. and the Canadian Westinghouse Co. The particulars following were recently made public by the Engineering Department of the latter company, and may be taken as typical of the machines of both companies.

The magnitude of these sets may be judged from the first illustration; the height to the top of the exciter, which is mounted directly upon the main shaft, is 35 ft., and the diameter of the generator casing is 24.5 ft. The water turbines are of the Wellman-Seaver-Morgan type, developing 55,000 h.p., and the generators produce 3-phase, 25-cycle current at 12,000 V.

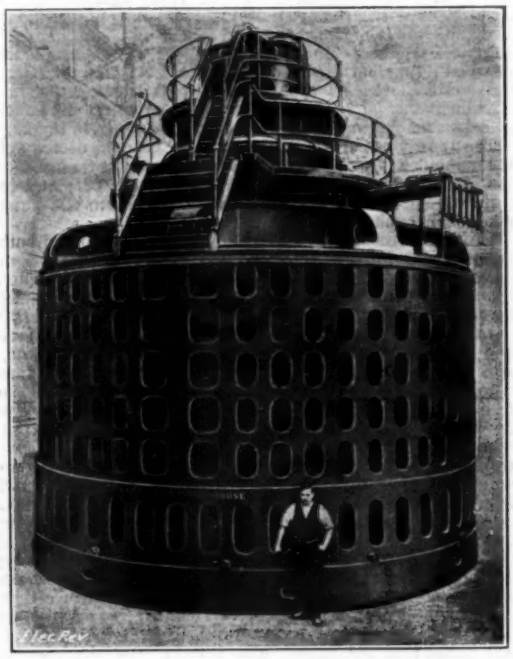


Fig. 1.—A Queenston 45,000-kVA Turbo-Generator.

Fig. 2.—An Armature Coil.

The stator of one of these machines is shown in fig. 3. The frame is an annular cast-iron ring webbed at the base at frequent intervals. It is in five parts: first, there is a solid base ring, and then the upper part, which is divided into four radial sections, each of which is 10 ft. in height and weighs 42,000 lb. The armature core is built up of segmental laminations of thin sheet steel. After these were punched, and before assembly, they were annealed and enamelled. In building the core, vent ducts, spaced about two inches apart, were put in between the layers, extending all round the core. The laminations are braced together by heavy bolts and cast-iron end plates. The winding of the armature is carried out with copper strip of rectangular section, there being a number of strips in each conductor. The individual strips forming a conductor are insulated from one another by means of mica tape, and the complete coils are covered with "micarta foliun" insulation—a compound patented by the Westinghouse Co. This insulation has a high dielectric strength, is very compact, and withstands high temperatures. A complete armature coil is illustrated in fig. 2. The connections between the various parts of the winding are made of insulated copper straps carried on supports above the upper ends of the coils. The windings are arranged for star connection, and both ends of each phase winding are brought out through the frame in order that protective relays may be inserted in each circuit, while between coils in the slots a number of thermo-couples are distributed throughout the winding for checking the temperature of the various parts.

The rotating field consists of 15 laminated poles dovetailed to the rim of a spider mounted on the shaft. The field coils are composed of insulated heavy copper strip. Sheet asbestos and shellac are used in insulating between turns, while on the inside of the coils, adjacent to the poles, and on the upper and lower edges of the coils, insulation consisting of mica, asbestos, and bakelite is built up and moulded to shape. The coils were baked after insulation. Although the peripheral speed of the spider is not excessive, a laminated steel rim is used, owing to the uniformity of the material. The hub of the spider is a webbed steel casting secured to the shaft by a heavy steel key. On the lower side of this hub there is a brake ring to which air brakes, mounted on the lower bearing bracket, can be applied in case of emergency. The hub weighs about 55,000 lb.

The shaft is a hollow steel forging with a bore of 8 in. Its total length is 30 ft., its diameter at the hub is 32 in., and it weighs 70,000 lb. The leads from the field coils are carried through the shaft to the cast-iron collector rings mounted on the shaft above the thrust bearings.

The upper and lower bearing brackets are of cast iron, heavily webbed for strength and rigidity. The approximate weights of the upper and lower brackets are 80,000 lb. and 45,000 lb. respectively. There are three bearings to the generator; the main one is a 69-in. Kingsbury thrust bearing carried on the upper bracket. This bearing is designed to carry a load of 1,000,000 pounds, including the rotor and the water thrust on the turbine. The rotating part of the bearing consists of a carefully-surfaced cast-iron collar fastened to the shaft. This collar is supported by babbitt-faced segmental steel shoes which are pivoted so that they can rock a little in any direction. The complete bearing is immersed in oil which is cooled by water circulating in copper tubes. The oil is also circulated. Two guide bearings are also used; one of these is placed above the rotating field and is mounted on the upper bracket below the thrust bearing; the other is below the rotor, upon the lower bracket. The bearing housings are of cast iron, arranged with water jackets through which cooling water is circulated. The bearings are lined with babbitt, which has numerous grooves to carry the oil to all parts of the bearing surface. Forced lubrication is employed.

The cooling of the generator is accomplished by forced ventilation. Free air is drawn up from underneath the generator, from which it passes through the spider to the upper part of the rotor. Vane blowers attached to the spider distribute the air uniformly to various parts of the generator, from which it passes through the various ducts in the iron and openings in the coils and the frame to the space between the generator and the walls of the pit in which the machine is mounted, from whence it is drawn by an exhaust fan. Openings in the generator leading to the generator room above, in which is situated the upper part of the machine, consisting of the thrust bearing and exciter, are closed by means of sheet steel covers. The quantity of free air passing through the generator is about 120,000 cu. ft. per minute.

Fig. 3.—The Stator of the 45,000-kVA Generator.

At present the machine described is the largest of its kind in the world, and the firm which designed and constructed it, as well as those which are building similar sets, is to be congratulated upon the accomplishment of a splendid engineering feat.

LEGAL.

WHITEGATE BRICK CO., LTD., *v.* O'BRIEN & CO.

In the King's Bench Divisional Court on July 12th, Justices Lush and Bailhache heard appeals from the decision of a Special Referee in this case arising out of the purchase and supply of an electric motor.

Mr. ROWSON, for the plaintiffs, said that towards the end of 1920 they were anxious to install an electric motor in their brickworks, and they approached the defendants for that purpose. They pointed out to the defendants that they wanted a motor for traction current. Defendants supplied a motor which was put into the works, but within the first three days there was trouble with it, and it eventually burnt out. Plaintiffs therefore brought an action to recover the price paid and for damages for breach of contract. The case came before Commissioner Parfitt at Manchester Assizes, and he came to the conclusion that it was a technical matter, and referred it to arbitration. Professor Walker, of Manchester University, was appointed special referee for the purpose. The case was heard by him about March of this year. The arbitration was closed, and then, without the plaintiffs' consent or knowledge, the Referee heard, or had a conversation with, certain gentlemen employed by the English Electric Co., who were the manufacturers of this motor, and carried out experiments at their works, of which plaintiffs were not notified. The award was made in the defendants' favour, and each side was ordered to pay its own costs. Plaintiffs now appealed against the whole award on the ground that the Referee had committed legal misconduct by hearing these gentlemen, and plaintiffs asked for the award to be set aside. O'Brien & Co. were the agents of the English Electric Co. in Manchester.

Mr. MORESBY, for the defendants, contended that the test carried out by the Referee was done with the consent of both sides, and there was no evidence that the persons who witnessed it were witnesses at the arbitration. The test was made after the arbitration was closed.

Mr. ROWSON said his clients thought this was to be merely an inspection of the motor and not a test; and if his clients had known there was going to be someone there representing the English Electric Co. they would have had one of their own experts there. The real defendants were the English Electric Co., and they were backing O'Brien & Co. There was no suggestion throughout the correspondence from the Referee that he was going to conduct a test. As a matter of fact, the plaintiffs did not agree with the results of the test.

Mr. Justice LUSH: Everything seems to have been above board. You knew what he was going to do.

Mr. ROWSON: We did not know he was going to have representatives there from the English Electric Co.

Mr. Justice LUSH: How could he do what he was going to do without assistance?

COUNSEL: He could have taken one of his own assistants.

Mr. Justice LUSH, giving judgment, said it appeared from the correspondence that the Referee took special care to inform the plaintiffs' and defendants' solicitors that he wished to inspect the motor. He had gone further, and said he wished to have a test, and plaintiffs' solicitors did not object to the test. In making the test, therefore, there was no doubt the Referee acted with the knowledge and consent of the plaintiffs. It was impossible to make a test without saying something to the employés at the works, who would know how to put the motor in a proper condition for the test to be made. There was not a particle of evidence that the Referee did anything more than what was necessary to obtain the test, and no evidence that anything passed between him and the employés of this company about anything except the test he was going to make. He therefore held it was not proved that the Referee had been guilty of any misconduct.

Mr. Justice BAILHACHE concurred, and the appeal was dismissed, with costs.

Their Lordships then heard the defendants' appeal against the order of the Referee that each side should pay its own costs.

Mr. MORESBY submited that the wrong principle had been applied, and that it was wrong that the defendants, who had been wholly successful, should have to pay. The Referee laid down the extraordinary principle that it was the duty of the defendants to acquaint the plaintiffs of the fact that the latter had no case.

Mr. Justice BAILHACHE: I suppose you said in your defence to the action that the plaintiffs had no case?

Mr. MORESBY: Most emphatically.

After hearing counsel for the plaintiffs, their Lordships held that the fact that the defendants did not acquaint the plaintiffs with their view that plaintiffs were wrong could not be a ground for depriving them of their costs.

Defendants' appeal as to costs was therefore allowed.

FAIRCHILD *v.* LYTHAM PIER CO.

At Blackpool County Court, on July 12th, John Fairchild claimed £27 from defendants for professional services connected with the electrical installation on the Pier and direction of repairs to a dynamo.

The action had been remitted from the High Court.

Plaintiff said he agreed to accept 18 guineas, but stipulated that it was without prejudice.

PLAINTIFF, engaged by St. Annes Electricity Works, said there was no fixed rate of remuneration. He not only advised on the strength of cable and wires, but on the whole installation.

The JUDGE, in an argument in which it was admitted that plaintiff had received a cheque for £18 18s., described the case as "a storm in a tea-cup."

Judgment was entered for the defendants, with costs, defendants stating that plaintiff had agreed to accept £18 18s. in settlement.

B.T.H. LAMP PATENT INFRINGEMENT CASES.

LORD BLACKBURN, in the Court of Session, Edinburgh, on July 12th, delivered judgment in three actions at the instance of the British Thomson-Houston Co., Ltd., against (1) Naamlooze Vennootschap Pope's Metaaldraadlampenfabriek, Venlo, Holland, and Charlesworth, Peebles & Co., mechanical and electrical engineers and merchants, 134, St. Vincent Street, Glasgow; (2) Charlesworth, Peebles & Co.; and (3) King and Co., Leith Electric Works, Prince Regent Street, Leith, in each of which the pursuers concluded for payment of £5,000 as damages for infringement of patents belonging to them.

The Lord Ordinary in the first action granted decree against the defenders conjointly and severally for payment of £760 13s. 4d.; in the second action for £1,770 7s. 6d.; and in the third action for £39 1s. 10d., with expenses to the pursuers, taxed as between agent and client.

His LORDSHIP said the defenders on record disputed both the validity and infringement of the patents, and he allowed a proof. Before going to proof, however, the defenders admitted the validity and infringement, and the only question left to be decided was the damages to which the pursuers were entitled in each case. The pursuers not only manufactured and sold lamps themselves which embodied their patents, but also granted licences to others to do the same on payment of royalties on the lamps sold. In these actions they had elected to measure the damage by the amount of royalties they would have received had the defenders been their licensees, and as such entitled to use their patents. The defenders argued that this method was inapplicable to part of the period during which lamps were sold by some of the defenders in infringement of the 1913 patent. It appeared that this patent was on November 15th, 1920, held to be invalid in England by the Court of Appeal. This judgment was, however, reversed by the House of Lords on December 19th, 1921. It was argued that during this interval the pursuers would have been unable to issue licences, and that therefore this method of estimating damages was inapplicable. It was further suggested that the defenders, having sold lamps during this period in the *bona-fide* belief that the patent was invalid, the damages to be assessed should be merely nominal. His Lordship was unable to give effect to either of these contentions. The defenders certainly had good cause for believing the patents to be invalid; but, in relying on the judgment of the Court of Appeal before that judgment became final, they took the risk of its being reversed. In using the patents without a licence they acted improperly, and the royalties which they would have paid had they been licensees provided, in his Lordship's opinion, a fair measure of the pursuers' loss through their improper action. After an examination in detail of the expert evidence, his Lordship reached the conclusion that damages were due in the amounts for which he granted decree.

The First Division of the Court of Session on Saturday disposed of reclaiming notes for the respondents in actions of suspension and interdict at the instance of the British Thomson-Houston Co., Ltd., London, against Charlesworth, Peebles and Co., Glasgow, and King & Co., Edinburgh, in which the complainers asked to have the respondents interdicted from importing and selling incandescent electric lamps having a filament of tungsten or other refractory metal of large dimensions or of cross section or of concentrated form and a gas or vapour of low heat conductivity at relatively high pressure or otherwise in infringement of letters patent belonging to the complainers. The respondents, before the Lord Ordinary, put in a minute withdrawing their defences, but they maintained their plea that, in any event, interdict could not competently be granted against exporting such lamps from the United Kingdom, which did not in itself constitute an infringement.

In the Outer House, Lord Blackburn granted interdict.

The First Division on Saturday, Lord Skerrington dissenting, dismissed the reclaiming notes, and affirmed the Lord Ordinary's interlocutor, with expenses as between agent and client.

The Lord President said the prayer craved interdict against both importation to this country and exportation from it, as well as the usual interdict against making, using, exercising, and selling. The reclaimers frankly explained that, while they had no intention of importing for use or sale in this country, their desire was to be free in the matter of exporting from it. If there was the smallest chance that the reclaimers would regard themselves free—under an interdict which did not expressly include exportation—to import these lamps and, instead of selling them in this country, to export them to purchasers abroad, it was very clear that exportation should be covered by the interdict. The reclaimers also explained that

they anticipated receipt in the future from the Dutch maker, or other persons, of infringing lamps among, or in lieu of, supplies of non-infringing lamps ordered by them. This might no doubt occur by mistake; and they desired to be free in such an event to return the goods without incurring penalties for breach of interdict. It was accordingly suggested that a refusal on their part of the infringing goods which they had not ordered, and the return thereof to the sender—if that was all that was intended—might easily be reserved to them (if necessary) by a few qualifying words to the interdict. But they declined to avail themselves of an opportunity of proposing such words which was afforded to them. His Lordship thought in these somewhat unusual circumstances it would not be fair to the patentees to refuse interdict, in the case of merchants of this class of goods, against exportation.

Lords Mackenzie and Cullen concurred.

Lord Skerrington, who dissented, thought the interdict granted was unduly wide in that it restrained the respondents from infringing the complainers' patent by exporting the lamps from the United Kingdom. He thought the interdict ought to be limited by omitting the words "or exporting therefrom."

Fatality at Leeds Electricity Works.

At Leeds City Police Court, on July 12th, the Leeds Corporation Electricity Department was fined £20 and costs for a breach of the Factories and Workshops Act, which had resulted in the death of a workman named George Brown, whilst cleaning the switchboard at the main generating station. Mr. Saywell, from the office of the Director of Public Prosecutions, contended that the gear should have been better screened or that the switchboard should have been rendered "dead" before work on it was undertaken. Mr. H. O. Brown, of the town clerk's department, defending, said the staff at the electricity works had not interpreted the regulations in the way they were interpreted by the Home Office, but since the accident they had been fully observed in that way, and would continue to be so.

Cannock Chase Colliery Co., Ltd.

In the Chancery Division on July 14th, Mr. Justice Astbury sanctioned an alteration of the articles and memorandum of association of this company by an extension of objects so as to enable the company to become undertakers for the supply of electricity for power and light. Counsel for the company said this proposed new business would be subsidiary to its main business of colliery owners. The company already had a generating plant for the supply of energy to itself, and its cables were in a suitable position for the distribution of power to the district. There was a large demand for power from the area, which included Cannock Chase, and an inquiry was recently held by the Electricity Commissioners as to the requirements of the districts within the area.

His Lordship said any order he made would be subject to what might be done by the Commissioners.

Counsel agreed, and said the company could do nothing till permission was given it, and its petition to the Court was only for power to undertake the supply of power of which it had a large surplus.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JUNE, 1922.

The June returns of electrical export and import business, which we tabulate below, show a further falling off in all sections.

The exports, which in May were valued at £840,017, fell in value to £782,656 in June, the decrease being mainly attributable to the falling off in the machinery, telegraph and telephone, and electrical goods and apparatus exports, while only in one section was a minor increase in value recorded. The electrical imports also showed a decrease in value of £5,000 as compared with the previous month. The re-exports totals for the month were £11,543, as compared with £17,769 in May.

	Exports.	Imports.	Re-exports.
	£	£	£
Electrical goods and apparatus	83,145	34,988	4,060
Insulated wires and cables ...	114,570	11,008	16
Glow lamps	28,646	11,588	528
Arc lamps and parts	1,186	2,552	15
Batteries and accumulators ...	42,867	6,797	15
Meters and instruments ...	19,120	5,000	549
Carbons	2,446	2,614	523
Electrical Machinery—			
Railway and tramway motors	17,307	—	—
Other motors and generators ...	144,780	—	—
Switchboards (not telegraph or telephone)	12,967	199	—
Electrical machinery (unenumerated)	100,658	112,697	3,812
Telegraph and Telephone Cable and Material—			
Telegraph and telephone wire and cable (not submarine)	26,975	1,258	—
Submarine telegraph and telephone cable	44,821	—	—
Telegraph and telephone instruments and apparatus ...	143,168	13,780	2,005
Total	£782,656	£202,481	£11,543

PARLIAMENTARY NOTES.

(By Our Special Parliamentary Reporter.)

Ayr Burgh Electricity Bill.—On July 12th, a Committee of the House of Commons again considered this Bill, and, as the Kilmarnock Town Council had withdrawn its opposition to the Bill, the three other petitioning parties took the same course. The Committee, therefore, unanimously found the preamble of the Bill proved. The effect of the agreements which were arrived at is that Ayr Burgh and County and Kilmarnock Burgh will have a joint electricity undertaking, constituted by the co-operation of all the existing plant of the three local authorities, as well as the transfer of the new statutory powers for the Loch Doon scheme. On July 13th the Committee gave formal approval to the new clauses giving effect to the terms of the agreement.

Post Office (Pneumatic Tubes Acquisition) Bill.—During the Committee stage of this Bill, on July 13th, Mr. Kellaway, the Postmaster-General, said that the tube which the Post Office proposed to utilise was one which had been lying derelict for 40 or 50 years, and the Borough Councils of St. Pancras and Holborn and also the London County Council had made incursions into certain parts of it. But the portions of the tube interfered with by those incursions was extremely limited, and they would be got over by the Post Office engineers by an inexpensive diversion which would in no way interfere with the telegraph and telephone lines which would be laid. The Post Office had got a bargain, and he was advised by competent engineers that if instead of being able to use this tube for carrying the wires, they had to open up the streets and lay new ducts in which to place the wires, it would cost between £50,000 and £70,000. They were now getting a tube which, over the greater part of its length, had not been interfered with in any way and was still sound, for £7,500.

The Black Country Tramways and Light Railways Bill.—This Bill, on July 13th, was read a first time in the House of Commons and referred to the Examiners of Petitions for Private Bills. The Bill seeks "to make provisions with reference to the undertakings of the Birmingham District Power and Traction Co., Ltd., the Dudley, Stourbridge and District Electric Traction Co., Ltd., the South Staffordshire Tramways (Lessee) Co., Ltd., and the Wolverhampton District Electric Tramways, Ltd." The Bill has already passed through the House of Lords.

Iron and Steel Trades Unemployment.—On July 11th Sir M. Barlow, Parliamentary Secretary to the Ministry of Labour, informed Mr. T. Thomson that the numbers registered as wholly unemployed in the iron and steel manufacturing trades were 150,361 on May 27th, 1921 (the time of the coal stoppage); 91,395 on December 2nd, 1921; and 89,821 on May 22nd, 1922. The corresponding percentages of unemployment were 57.8, 35.1, and 34.1 respectively.

Wireless Broadcasting.—On July 18th, Lieut.-Col. A. Murray asked the Postmaster-General whether any decision had been reached as to the terms and conditions under which licences for wireless broadcasting were to be issued; and whether the licences were to contain a provision that only British instruments should be used.

Mr. Kellaway said that he had intimated to a Committee representing the manufacturers of wireless apparatus in this country the conditions on which he proposed to grant licences for broadcasting, and he understood those proposals would be submitted to the general body of manufacturers forthwith. He had informed the manufacturers that in the event of their supplying the capital required and providing efficient broadcasting services, he would agree that the apparatus which it would be permissible to use under the Post Office licence for the reception of those services, should for two years be restricted to apparatus manufactured in Great Britain.

Discussion followed, in the course of which it was asked whether the Postmaster-General had the power to do what he proposed. In reply, he stated that he had power under the Act passed by that House to issue licences, and it was inconceivable to him that we should allow a new form of communication in this country to be exploited by foreign manufacturers. He was not taking advantage of the powers of licence to impose a protective system in this hole and corner way. He was imposing a proper method of protecting a new means of communication in this country.

Railless Traction.—On July 13th Sir R. Clough asked the Parliamentary Secretary to the Ministry of Transport what was the policy of his Department towards railless traction, and whether, in view of the need for efficient roads where it was

used, he was stimulating the policy of more enduring road reconstruction.

Mr. Neal said that subject to the design and weight of railless trolley vehicles being suitable to the roads on which they were run, he saw no general objection to them, but each case must be judged on its merits. There was no substantial difference from the road damage point of view between railless trolley vehicles, motor omnibuses, and other heavy traffic, and no special kind of road reconstruction was necessary.

Aluminium Imports.—On July 17th Mr. Baldwin informed Mr. Hogge that the imports of aluminium domestic hollowware into the United Kingdom, consigned from Switzerland, registered during the first six months of this year amounted to 25 tons.

South Wales E.P.D. Co. Bill.—On July 17th the South Wales Electrical Power Distribution Co. Bill, which has passed through the House of Lords, was read the third time.

London Bills.—The House of Lords has agreed, without amendment, to the London Electric and City & South London Railway Companies Bill, to the L.C.C. (General Powers) Bill, and to the L.C.C. (Money) Bill.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,802. "Mine-shaft signalling apparatus." W. B. Dale, R. A. Hopkinson, and J. Hopkinson & Co., Ltd. June 28th.
17,805. "Control of electric motors." C. C. Garrard, A. H. Railing, and W. Wilson. June 28th.
17,807. "Distributors for electric ignition devices in internal-combustion engines." W. H. Cavender and H. G. Smith. June 28th.
17,814. "Alternating-current electric systems." Metropolitan-Vickers Electrical Co., Ltd. June 28th. (United States, June 30th, 1921.)
17,819. "Loaded signalling conductors." Western Electric Co., Ltd. June 28th. (United States, August 16th, 1921.)
17,822. "Telegraph receiving apparatus for producing punched tape." F. G. Creed and Creed & Co., Ltd. June 28th.
17,833. "Change-over switches for electric lighting, &c., of railway carriages, &c." A. H. Darker and J. Stone & Co., Ltd. June 28th.
17,842. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th.
17,843. "Systems of connections for railway train units." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th.
17,853. "Electro-magnets and electro-magnetic machines." S. I. Hitchcock. June 28th.
17,866. "Electric switches." J. A. Crabtree. June 29th.
17,874. "Electric motors and generators." H. J. Howard. June 29th.
17,888. "Obtaining intermittent unidirectional currents of electricity from alternating currents." A. Barnett. June 29th.
17,889. "Electric switches." I. Calvete. June 29th.
17,910. "Electric switch." G. Marr. June 29th.
17,914. "Electric heating units." W. Colebrook. June 29th.
17,915. "Electric clock." C. P. Williams. June 29th.
17,921. "Electric transformers." British Thomson-Houston Co., Ltd. (General Electric Co.). June 29th.
17,922. "Excitation of turbo-alternators." British Thomson-Houston Co., Ltd., and R. F. Halliwell. June 29th.
17,924. "Electric signalling, &c., lamps." W. R. Bullimore. June 29th.
17,929. "Electric advertising device." A. W. P. Young. June 29th.
17,932. "Electric primers, and manufacture thereof." Etablissements Davey, Bickford, Smith et Cie. June 29th. (France, January 30th.)
17,942. "Process for starting synchronous electrical machines." Akt. Ges. Brown, Boveri et Cie. June 29th. (Switzerland, July 30th, 1921.)
17,948. "Miners' lamps, &c." W. Morgan. June 29th.
17,951. "Quick-break electric switches." S. Cerf. June 29th. (France, March 29th.)
17,954. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. June 29th.
17,955. "Crystal detectors for wireless telegraphy." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. June 29th.
17,968. "Test point terminal." B. J. Davies. June 30th.
17,971. "Radio receiving apparatus." C. M. Farquhar and W. S. Stephenson. June 30th.
17,991. "Electric power transmission by means of underground cables." A. M. Taylor. June 30th.
18,002. "Preventing wireless interference." E. W. Whiston. June 30th.
18,025. "Aerials for wireless telegraphy and telephony." W. A. Chambers and R. M. Ellis. June 30th.
18,028. "Electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Anderson). June 30th.
18,048. "Sound-producing apparatus for electro-magnetic receiving or emitting device." Soc. des Etablissements Gaumont. June 30th. (France, February 17th.)
18,050. "Switching devices for telephone systems, &c." Western Electric Co., Ltd. June 30th. (United States, July 2nd, 1921.)
18,057. "Electrically insulating pipe section for high-vacuum pipe lines." Akt. Ges. Brown, Boveri et Cie. June 30th. (Switzerland, September 30th, 1921.)
18,064. "Sparking plugs." J. G. van der Weerd. June 30th. (Holland, December 31st, 1921.)
18,067. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th.
18,077. "Apparatus for coding, &c., telegraphic messages." A. Tracey. June 30th.
18,080. "Wireless receiving system." International Wireless Appliances Corporation. June 30th. (France, August 29th, 1921.)
18,098. "Electric fuses or cut-outs." V. Hope. July 1st.
18,106. "Manufacture of steel." P. R. Kuehnrich. July 1st.
18,113. "Electrically-operated indicators for theatres, &c." C. Lawson. July 1st.
18,115. "Vapour lamps for lighting, &c." A. C. Jones, A. Kirby, and Messenger & Sons. July 1st.
18,134. "Wireless receiving apparatus." C. K. Chandler. July 1st.
18,142. "Electro-magnetic vibrators, telephones, &c." Signal Ges. July 1st.
18,154. "Electric power transmission systems." A. M. Taylor. July 3rd.
18,190. "Electric fuse-box." R. Marr. July 3rd.
18,195. "Self-winding insulated reel for electric cables, &c." A. McKim. July 3rd.
18,197. "Oil-immersed electric switch fuses." H. W. Clothier and J. Mirrey. July 3rd.
18,199. "Leading-in tubes for electric installations." F. H. Weurman. July 3rd. (Holland, July 4th, 1921.)
18,203. "Time-setting device for controlling maintenance of electric current." L. Angel. July 3rd.
18,211. "Radio apparatus." C. B. Kerating. July 3rd.
18,219. "Measuring times, angles, lengths, and determination of direction of sound, &c., impulses." Signal Ges. July 3rd. (Germany, August 1st, 1921.)
18,222. "Submarine cables." Western Electric Co., Ltd. July 3rd. (United States, August 16th, 1921.)
18,224. "Supports for telephone transmitters." Automatic Telephone Manufacturing Co., Ltd. July 3rd. (United States, December 19th, 1921.)
18,225. "Electric motor control systems." Metropolitan-Vickers Electrical Co., Ltd., and L. Miller and W. Richardson. July 3rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

35,721. "Illuminating devices." Duplexalite Corporation. December 19th, 1919. (155,593.)
36,053. "Control of trains." A. R. Angus. December 23rd, 1920. (181,752.)

1921.

240. "Electro-galvanising machine." F. H. Rogers (Meaker Galvanising Co.). January 4th, 1921. (181,756.)
2,850. "Electro-magnetic wave-signalling systems." H. J. J. M. de Regnauld de Belleszize. January 22nd, 1920. (158,556.)
5,137. "Colliery trams." D. D. Jones and J. James. February 14th, 1921. (181,766.)
5,394. "Electric measuring-instruments of the hot-wire type." A. Lederer, jun. February 25th, 1920. (159,303.)
5,671. "Electric switches." H. B. Cornish. February 19th, 1921. (181,778.)
7,787. "Casing of substantially-rectangular shape, particularly adapted for electrical apparatus." Landis & Gyr Akt. Ges. March 13th, 1920. (160,136.)
8,233. "Electric cables for the conveyance of high-tension electrical energy." L. N. Reddie (Soc. Pirelli & Co.). March 16th, 1921. (181,796.)
8,277. "Reception of continuous-wave wireless signals." H. J. Round. March 16th, 1921. (181,799.)
8,331. "Dimming devices for the electric head-lights of motor road vehicles." B. H. O'Brien. March 17th, 1921. (181,803.)
8,370. "Sparking-plugs for internal-combustion engines." P. Challis. March 17th, 1921. (Cognate application 27,284/21.) (181,805.)
8,412. "Ionic or vacuum tubes or relays." W. J. Mellersh-Jackson (Compagnie Générale d'Electricité). March 17th, 1921. (181,812.)
8,606. "Electro-mechanically-controlled telephone system." H. Baron (F. Aldendorff). March 19th, 1921. (181,826.)
8,630. "Directional wireless apparatus." C. K. Chandler. March 19th, 1921. (Cognate application 19,727/21.) (181,827.)
8,735. "Railway train control." National Safety Appliance Co. October 27th, 1920. (170,814.)
8,948. "Portable switchboard." J. McCloskey and C. C. Berryman. March 23rd, 1921. (181,841.)
9,105. "Magneto-electric generators." M-L Magneto Syndicate, Ltd., and E. A. Watson. March 24th, 1921. (181,845.)
9,131. "Processes for carrying out electro-chemical reactions and apparatus for use therein." G. Plauson (née Hildenbrandt). March 24th, 1921. (181,848.)
9,132. "Processes for carrying out electro-chemical reactions and apparatus for use therein." G. Plauson (née Hildenbrandt). March 24th, 1921. (181,849.)
9,490. "Automatic electric switch or circuit breaker." E. C. R. Marks (Elektriska Aktiebolaget Volta). March 30th, 1921. (181,857.)
9,599. "Automatic electric circuit interrupting apparatus." G. A. Cheetham and Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1921. (181,859.)
9,771. "Method of fixing in place stator cores of induction motors and other laminated cores." Electric Construction Co., Ltd., and H. Jones. April 2nd, 1921. (181,867.)
9,857. "Electro-mechanical railway fog-signalling apparatus." G. A. Farmer, L. J. Coussmaker and E. A. Campbell. April 4th, 1921. (181,871.)
9,909. "Electrically-heated muffle furnaces." Akt. Ges. Brown, Boveri et Cie. April 4th, 1921. (Addition to 159,195.) (181,875.)
10,504. "Vapour lamps." W. H. Cleburne and E. J. Cleburne. April 9th, 1921. (181,885.)
10,561. "Transformers for high voltages." Akt. Ges. E. Haefely et Cie. October 16th, 1920. (170,547.)
11,274. "Telegraph keyboard perforators." A. C. Booth and A. S. Willmot. April 19th, 1921. (181,895.)
11,783. "Vacuum electric discharge tubes." E. C. R. Marks (Siemens and Halske Akt. Ges.). April 23rd, 1921. (181,903.)
12,131. "Speed-controlling devices for railway and tramway trains." E. Rudolausee. April 27th, 1920. (162,617.)
12,148. "Static frequency changers." Ges. fur Drahtlose Telegraphie and M. Osnos. April 27th, 1921. (181,909.)
12,318. "Synchronising systems, particularly applicable to printing telegraphs." Western Electric Co., Ltd. May 1st, 1920. (162,621.)
14,067. "Thermally-operated relays." Metropolitan-Vickers Electrical Co., Ltd. June 9th, 1920. (164,729.)
14,562. "Electric heating units." British Thomson-Houston Co. (General Electric Co.). May 25th, 1921. (181,940.)
15,204. "Permanent way signalling devices for railways." R. Johnstone. June 1st, 1921. (181,949.)
15,431. "Electric contact fingers." British Thomson-Houston Co., Ltd. (General Electric Co.). June 3rd, 1921. (181,953.)
15,485. "Spark plug." O. Trova. June 4th, 1921. (181,954.)
16,331. "Arrangement for the operation from a distance of an overload switch provided with a main current winding and a tension winding." F. Krupp Akt. Ges. August 20th, 1920. (168,040.))
17,583. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. June 28th, 1921. (181,985.)
18,215. "Methods of coating reflectors and the like with liquid enamel or similar material." British Thomson-Houston Co., Ltd. (General Electric Co.). July 5th, 1921. (181,989.)
19,258. "Electric door protecting alarms." R. Dittmayer. July 16th, 1921. (182,002.)
19,520. "Electrically heated appliances." C. W. Marriott. December 10th, 1920. (172,002.)
19,928. "Incandescent electric lamps." F. H. Eeles and A. J. Barnett. July 25th, 1921. (182,007.)
22,910. "Construction of rotors for high-speed dynamo-electric machines." Akt. Ges. Brown, Boveri et Cie. September 9th, 1920. (168,983.)
25,699. "Electric incandescent lamps and methods and apparatus for their manufacture." Patent Treuhand Ges. fur Elektrische Gluhlampen. November 20th, 1920. (171,974.)
27,053. "Auxiliary sparking unit for spark plugs." F. E. Wade. October 12th, 1921. (182,047.)
27,689. "Telephone systems." J. E. Pollak (Siemens & Halske Akt. Ges.). October 18th, 1921. (182,049.)
33,109. "Apparatus for dressing railway, tramway and like rails." F. Krupp Akt. Ges. April 30th, 1921. (179,507.)

1922.

1,129. "Electrical ignition apparatus." R. Bosch Akt. Ges. February 14th, 1921. (175,608.)
11,135. "Rotary pump." Metropolitan-Vickers Electrical Co., Ltd. May 19th, 1921. (179,916.)